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NEW ELECTRICAL DIAPASON.

BY GEO. M. HOPKINS.

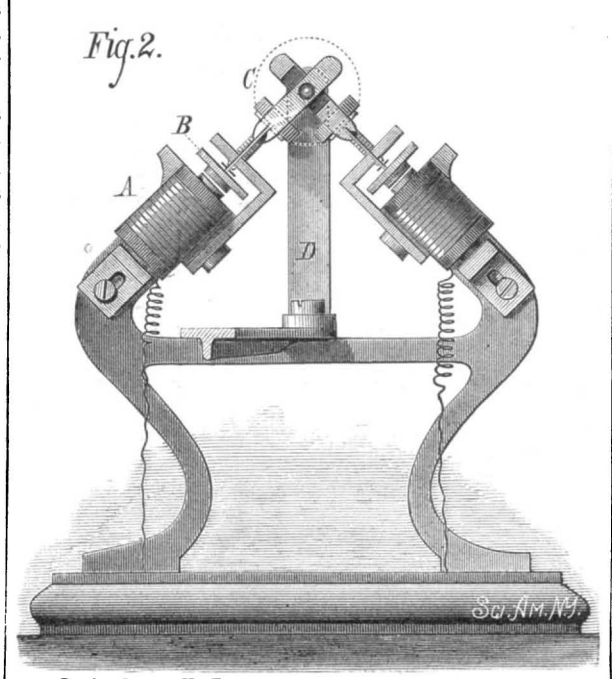
The graphic method of studying vibratory motions is deeply interesting, especially in these days of telephones and phonographs, when the properties of sound are being more thoroughly investigated than ever before. Several methods have been devised to render sonorous vibrations apparent. In the novel and beautiful method of M. Lissajous, two tuning forks or diapasons, each carrying a small mirror, are arranged so that by their combined movements a beam of light is reflected, forming upon a screen beautiful symmetrical figures, by which the vibratory motions of two sounding bodies may be compared without the aid of the ear.

Sir Charles Wheatstone, many years ago, contrived a small machine for compounding rectangular vibrations; and Professor E. A. Dolbear more recently devised an apparatus to be attached to a whirling table, for the purpose of vibrating two mirrors in different planes for projecting Lissajous' curves. These curves have also been drawn by means of pendulums.

In each of these forms of apparatus some desirable element is wanting. The forks lack continuity of action. The vibrating mirrors of Professor Dolbear may be operated continuously, but no sound accompanies their movements. The pendulum, while it produces beautiful figures, has neither the sound nor continuity of operation.

With a view to the construction of an instrument that would operate continuously and produce both sounds and figures, I first arranged two reeds or tongues to be vibrated by an electric current. These tongues were made adjustable as to length, so that their vibrations might be varied to produce fractions of a tone to illustrate the phenomena of consonance and dissonance. To each tongue I attached a mirror, and at first used the apparatus after the manner of M. Lissajous' tuning forks. I subsequently combined the two tongues in one instrument, and connected them both with a single mirror, so that it was actuated by both tongues. This instrument is shown in perspective in the large engraving, and the small cut (Fig. 2) is a front elevation, having some of the parts removed to show the construction more clearly.

Fig. 2.



FRONT ELEVATION OF ELECTRICAL DIAPASON.

Two steel tongues, B, are rigidly secured to the frame at one end, and are arranged relatively so that their vibratory planes are at right angles. Each tongue is clamped by a slide placed on rigid ways, and capable of being moved longitudinally by the screw that extends between the ways. The outer ends of the screw are squared to receive the key. The free end of each vibratory tongue projects over an electro-magnet, A, attached to the end of the frame, and has a light platinum spring on its upper side, which touches a platinum pointed contact screw that is connected with one terminal of the magnet wire; the other end of the magnet wire is connected with a binding post at the end of the instrument.

There are two binding posts for each vibratory tongue, as they must be operated by separate batteries. The electrical current passes through the tongues, the contact screws, and their supporting brackets, and through the magnets. The vibratory tongue acts like the ordinary spring commutator. The amplitude of vibration depends on the strength of the electrical current, and the rapidity of the vibrations depends upon the length of the portion of the tongue that is left free to vibrate.

A standard, D, projects upward from the frame and supports an adjustable tube, which is parallel with the tongues, and has in one end a piece of rubber or cork, into which is thrust the point of a stout needle, which also passes through

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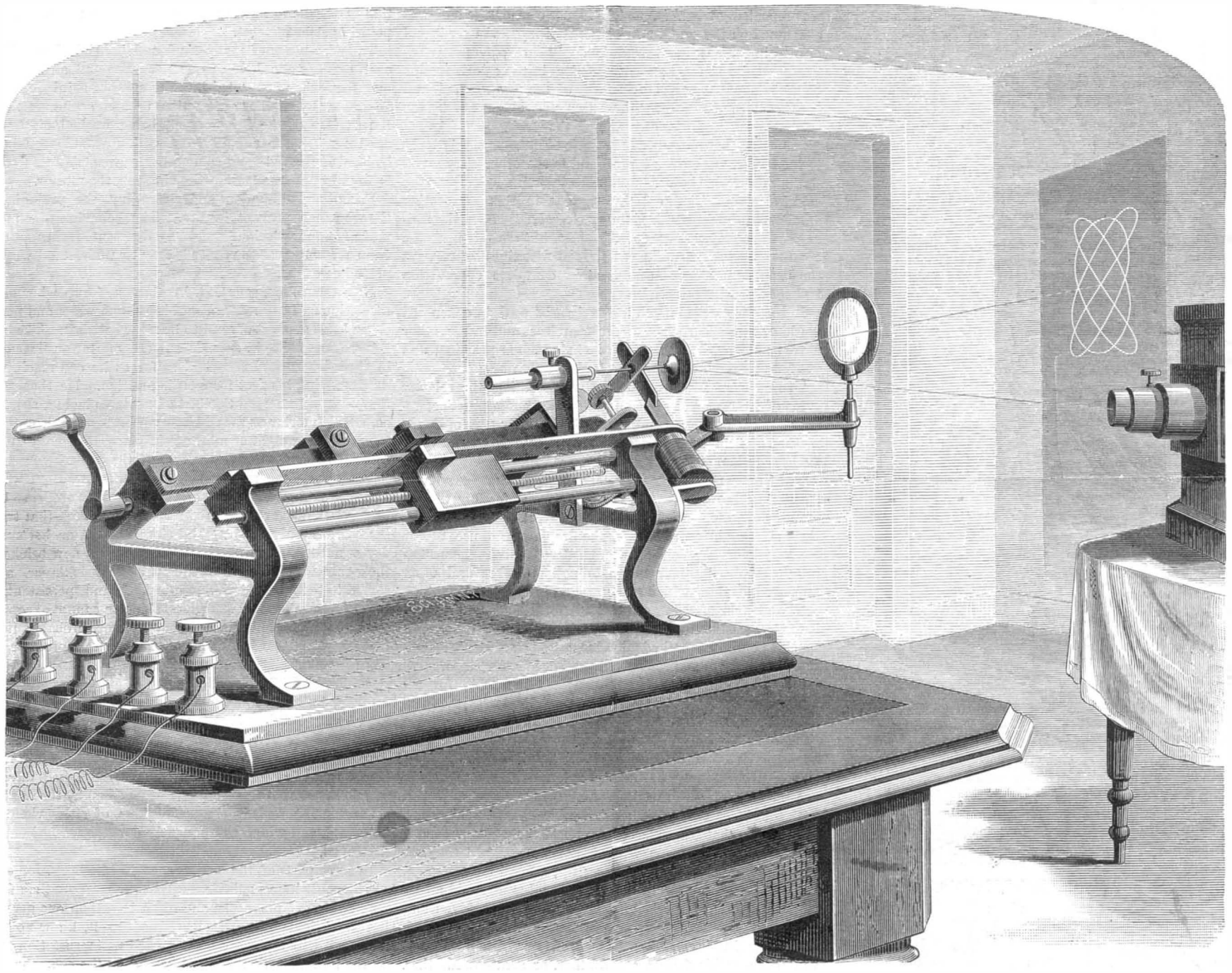

THE ELECTRICAL DIAPASON.

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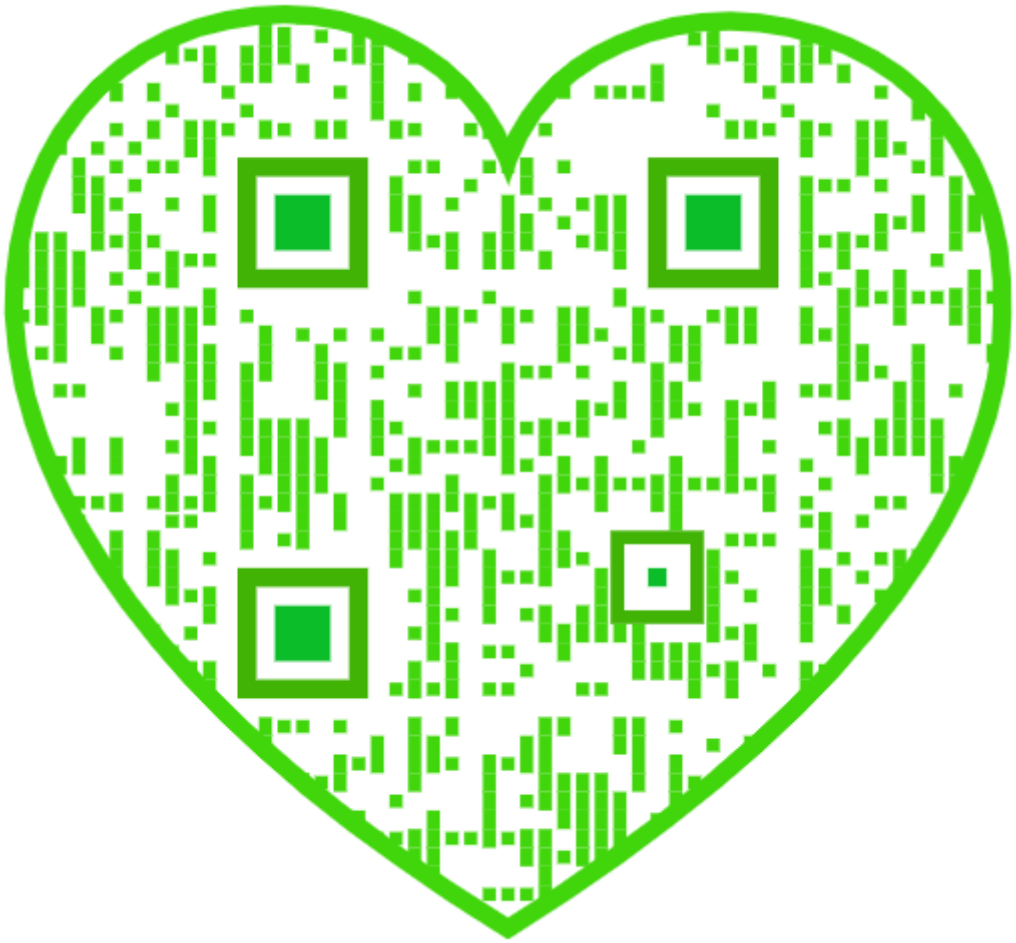

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NEW YORK, SATURDAY, OCTOBER 12, 1878.

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VIII. MEDICINE AND HYGIENE.—Paraffin Splints. By WILLIAM MACEWEN, Surgeon Royal Infirmary, Glasgow, showing in full detail the mode of application and the superior merits of this substance in Surgery. An excellent and valuable paper.—Extemporized Splints.

RELATION BETWEEN THE GRATE SURFACE AND THE HEATING SURFACE OF BOILERS.

The theory that for proper efficiency there must be maintained certain definite relations between the grate surface and the heating surface of boilers, so long held and persistently defended by engineers and boiler builders, has of late years suffered so many attacks as to be no longer tenable; yet even now there are many of its defenders who refuse to acknowledge the weakness of their position and take up the stronger one which is offered to them in the indisputable fact that the service of a boiler depends more upon the manner of its firing than upon any other special condition—complete combustion and slow consumption producing the best results.

In one way this fact is clearly demonstrated by the new style of locomotive in use on the Reading railroad for burning the hitherto useless anthracite culm. The dimensions of their common locomotive firebox are 60 and 66 by 32 inches; the new design is 8 feet 6 inches long by 7 feet 6½ inches wide; the heating surface of the firebox is 106 square feet, and of the combustion chamber 26 feet, making a total of 982 square feet. The grate rest is between water bars to prevent them from burning out, and the area is 64 feet. The consumption of coal is only 16 pounds per hour per square foot of grate surface against 40 to 60 pounds in the ordinary locomotive.

The fuel remains perfectly quiet in the firebox, the consumption is slow, the steam is more freely made than in the common style of locomotive boiler, and no smoke or sparks (an assurance of complete combustion) are ejected from the smoke stack.

This is an instance of superior boiler service obtained with much smaller consumption of coal, and that of an inferior quality, per square foot of grate surface, than old practitioners would have deemed possible. Its success must lead to extensive trials in this direction and greatly modify general practice.

Not long since a protracted series of trials was made by a board of experienced engineers to determine the relative value of as great a departure in another direction from the common practice of firing—the reduction of a stationary boiler grate surface from 17 square feet to 3 square feet, and the burning of the larger portion of the coal, reduced to a fine powder and injected on a current of air into the heated firebox, instead of consuming it all on the grate.

To begin with, most carefully conducted and repeated trials were made with Cumberland lump coal burned in the usual way on the full grate surface, 17 square feet; then, with the surface reduced to 3 square feet, the new process was repeatedly tried, in which 40 per cent of the coal was consumed on the grate, and 60 per cent injected over it and burned in the powdered condition.

The results showed an average gain in the calorific value of the coal of 30 per cent in favor of the new method, and the thoroughness of the combustion was evidenced by the total absence of smoke escaping up the stack.

In one of these instances the grate surface was, relatively to the boiler, very much larger, and in the other very much smaller than was before used, and in neither case was the calorific value of the fuel, or, what in this connection amounts to the same thing, the service of the boiler, dependent upon the relative area of the grate, but entirely upon the conditions—widely unlike as they at first sight appear, yet the same in principle—that assured complete combustion and slow consumption.

In the one case a much less weight of coal is consumed per hour per square foot of grate surface, and in the other a very much greater than is done in common practice; and yet both methods are found to lead to the same point.

The ratios of 25 or 30 to 1, as representing the relative areas of heating and grate surface in common practice, refer only to the best conditions obtained by the ordinary method of firing, which generally implies extreme waste of fuel: there is no direct relation between them.

The new methods of mechanical stoking—gradually sprinkling fine coal over the fire surface, feeding the fire from below, etc.—are all opposed to the old idea, as are also the radiating brick arch over the fireplace, the use of the steam jet for blowing the fire, the two fire boxes, consuming the smoke by their alternate action, and several other approved devices which are growing into use.

The manner of firing on which the old theory was based is too expensive in these times; new methods, each with special conditions and advantages, will be gradually substituted, and the most profitable investigations for steam engineers will be into the conditions most favorable for the highest economy in fuel and labor and the least dependent upon the unskillful fireman.

WAGES AND THE COST OF LIVING.

Comparing the present market prices of all the articles of necessity and luxury that go to make up the cost of living, with the prices that obtained when wages were higher, it will be seen that wages have fairly held their own. And if men will make the same comparison with regard to men's earnings and purchases, twenty, fifty, a hundred years ago, they will see that—thanks to cheaper and more rapid means of production and carriage through mechanical inventions—in every element of living, in housing, clothing, food, luxuries and the rest, the workman of to-day has infinite advantages over his father, grandfather, or great-grandfather. And he enjoys a multitude of privileges and benefits, in stable government, personal liberty and protection, gratuitous education for his children, free medical attendance, pure water, lighted streets, and other untaxed advantages which his ancestors never dreamed of or hoped for. His wages are higher, and his money will buy more, dollar for dollar, than his father's would.

We do not say that the real as well as relative cost of living is not advanced by every step forward in civilization. For ten days' work an East India Islander, according to Wallace, can manufacture or earn sago cakes enough to last him a year; and less labor will keep him supplied with the limited clothing he needs. A man needs more clothing here, and a greater variety of food; yet when it comes to the absolute necessities of men—the minimum cost of living—a very small portion of a man's yearly wages will keep him alive and comfortable. Thoreau built him a shanty in Waldon Woods and lived a year in it at a total cost of twenty-seven dollars, and never approached either squalor or starvation. The experiment is of value only in that it proves it possible for a man to get as much bare living here for a given amount of labor as a Polynesian can. If one wants more—and very properly most men do want more—one must work for it; and our civilization happily offers at once more opportunity for labor, and infinitely more to be had for the proceeds of such labor, than have been attainable in any other land, under any other social or industrial conditions. And we doubt whether there was ever a time when industry and economy—using the term in its true sense, of judicious management—would or could have met with a surer or more generous reward, than in our own land to-day.

MAGNESIAN LIME VS. PURE LIME FOR MORTAR.

The cause and the remedy for the white efflorescence which so commonly disfigures brick house fronts are the subjects of a recent paper by Mr. Henry Pemberton, published in the *Journal of the Franklin Institute*. The causes are two: first, the existence of silicate or other salts of magnesia in the brick clay, converted into sulphate of magnesia, in the process of burning in the kilns, by the sulphurous vapors from the coal; and secondly, the employment of lime containing magnesia for the mortar used in the walls, which, by the absorption of the sulphurous vapors of the coal gases in the general atmosphere of the city, becomes converted into sulphate of magnesia, and, being dissolved by the rain, penetrates the substance of the more or less porous bricks, efflorescing ultimately upon the surface.

This efflorescence is also an indication of a serious evil, namely, the disintegration of the mortar uniting the bricks, causing the washing out of the joint and consequent destruction of the buildings, or compelling their refilling and repointing at heavy cost.

The percentage of magnesia found in brick clay rarely, if ever, exceeds one half of one per cent, and although this quantity, when converted into the soluble sulphate, would be drawn by capillary attraction to and accumulate upon the surface of the bricks, yet, being washed off by successive rains, the supply from within would soon be exhausted if not fed from some other source, and this source is found in the magnesian lime used in the mortar.

Pure lime is abundant and cheap, but the prejudices of the workmen prevent its use. The behavior of a mortar made from magnesian lime is so different from that made from pure lime as to render it easy to understand why the prejudice exists.

Magnesian lime, says Mr. Pemberton, forms when slaked a gelatinous, fatty mass, absorbing much water and permitting a large amount of sand to be mixed with it. The bricklayer, when using it, spreads out the mortar on the surface of the brickwork already laid as far as he can reach, without removing his feet from their position. He then places the brick in line upon this bed of mortar, placing, as he does so, a little mortar on the end of each brick as laid, until perhaps seven or eight or more are in place, then points up the brick with the trowel on the face of the work.

With pure lime mortar this plan will not do. The mortar when laid on the brickwork becomes soon so firm—being less gelatinous or pasty than the magnesian—that two or three bricks only can be laid before it sets, or becomes so dry as not to make a proper bond with the new bricks and those already laid. Consequently the bricklayer, accustomed to the magnesian lime, promptly and persistently rejects the pure lime as worthless, since he cannot execute the work expected of him in a given time, nor, probably, if used by him, would the bricks be securely and properly bedded. The purest quality of lime is found, for instance, within a few miles of Philadelphia, and is sold at a lower price than ordinary builders' lime, and yet it will not be accepted or used by the builders for the reasons given above.

An analysis of the lime used in a block of handsome dwellings now being erected there shows it to contain nearly 38 per cent of magnesia, which is readily attacked, dissolved and formed into a soluble salt (Epsom salts) by the sulphuric acid which abounds in the atmosphere of cities where coal is burned, and which consequently must be washed out and destroyed.

In some parts of the country, as in Pittsburg, for example, the only lime available rarely contains more than five to six per cent of magnesia, and often less than one per cent, but the bricklayers are accustomed to it, know no other, and use it with entire satisfaction; and no incrustation occurs on the buildings there, notwithstanding the enormous consumption of coal in the city and neighborhood.

The Pittsburg bricklayers would undoubtedly object to

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the more easily worked magnesian lime of Philadelphia, because it requires a different manipulation. Such are the prejudices formed under the influence of local habit.

NOVEL APPLICATIONS OF DYNAMITE.

From a long article on trials with dynamite in one of our London exchanges, we condense the following valuable report of its use in breaking up a wrecked iron ship and otherwise:

The wreck was that of the steamship Oscar, of Leith, which ran ashore at Whitby; she was of 1,258 tons gross, 824 tons net register, 261 feet long, 31 feet beam, 23 feet depth of hold, and 110 horse power. A futile attempt was made to break her up with gunpowder; subsequently dynamite was tried.

A charge was made up in a common canvas hose from 9 to 10 feet long, consisting of 30 pounds of dynamite, with an extra 10 pounds in a lump fixed firmly to the end. The diver took this charge and placed it in the lazarette, the heavy end being fixed against the stern frame and the tail part trailing forward along the starboard side as the wreck lay on that side. After the diver cleared out the charge was exploded, the result being that the stern frame and all the steering gear were smashed out and lay on the rocks, and the starboard quarter was parted right away. The next charge, placed in the port bow close to the fore foot, blew the fore foot away and ripped the port bow plates through, and the wreck fell over separated from the keel upward.

Several small charges were then exploded in the cylinders and on the condenser, breaking them up. A five pound charge, lowered into the crank pit, blew down the remaining part of the engines and condenser in such an effectual manner that the diver was enabled to send up the condenser and about two tons of brass in half an hour the next day.

The charges were fired by the ordinary "time sea fuse," a long length of which takes as much as a quarter of an hour or twenty minutes to burn to the charge. This is a great loss of time in a tide, and in future electricity will be applied.

No trouble was taken to make the canvas hose that inclosed the charges waterproof, though dynamite is practically unaffected by water for several hours. Put in India rubber hose it would remain for a long time under water without being injuriously affected. In work of this character it is completely successful where gunpowder and gun cotton have failed, and being of a plastic nature, it possesses the advantage of being moulded and pressed into any shape, such as angles, square holes, etc.

Iron masts, beams, chains, and wire rope are cut off by tying small canvas hose containing dynamite round them, and then exploding it.

In the instance of the iron steamship City of Venice, which went ashore on the rocks, after every other plan to raise and haul her off had failed—she had rocks through her bottom in some places four feet high—dynamite was tried. The rocks protruding through the vessel were first removed by use of small charges; the tops of the rocks outside of the vessel were then blasted away, and the vessel was got off without further injury, and saved.

So powerful and effective an agent should be better understood and applied to more purposes than it is. Not only can it be used to remove rocks surrounding a vessel, but in the case of a vessel stranded on a sand or mud bank a channel could be excavated, it seems to us, by the use of long tubes filled with the dynamite; and for open cuttings for roads such tubes could be laid in furrows made by machines like those in use for excavating for drain tiles, and fired with good and economical results.

PROGRESS OF WESTERN MINING OPERATIONS.

The action of the Committee of Security of the New York Mining Exchange, in sending their chairman to Colorado for the purpose of obtaining, by personal observation and in other ways, more accurate knowledge of certain mining properties which are offered in this market, is worthy of high commendation. In a two months' investigation he has found that actual frauds have, in some cases, been forced upon the market here, and that most of the other mines have been overrated.

The dishonest and speculative element, though much weakened by the many successful legitimate enterprises that have been established there within the past two or three years, is, in fact, still powerful, and will finally yield only to the persistent force of public opinion as represented by the scientific and mining press and the various mining exchanges of the Eastern cities, whose aim it should be to discover and explode all mining bubbles.

Our opinion, that if the truth concerning the mining interests there were generally known, a large amount of Eastern capital would be invested there, is fully indorsed by this gentleman, as it must be by all conversant with the conditions.

Intensified by the severe lessons of the past the conservatism of Eastern capital must, ere long, remove the reproach of speculative mining which has so retarded the growth of Colorado, and which is still the curse of the mining regions farther West.

We do not by any means wish to imply by this that intelligent observation and good judgment cannot find as many opportunities for profitable mining on the Pacific slope and elsewhere as in Colorado, but simply that the elements opposed to legitimate and favoring speculative mining exist there in fuller life and vigor, and apparently control nearly all operations. In evidence we quote from a late San Francisco exchange: "The mining share market is now being flooded with outside stocks, every day witnessing the placement of some new wildcat, which seemingly is selling like hot cakes, but for the genuineness of which we would not vouch. Under the present buoyancy many shares may be sold at reported prices, but the advance is altogether too sudden to be fully real, and in this respect we would caution parties about being over-anxious to invest, for this is the opportunity for the free manipulation of all those claims that have no merit whatever."

The mainsprings of these conditions are the continued remarkable output of some of the Bodie District mines, and the new lease of life which it is supposed the Sutro tunnel will give to the mines of the Comstock lode, the output of the Bodie mine alone, for the month of August, being estimated at $700,000.

From the Black Hills there are encouraging reports of the quality and abundance of the gold and silver ores and of the activity of the mining business; already 135 stamps are at work on ore from one mine there, and 80 at another, from which last $40,000 in gold was cleared up in about a two weeks' run.

From Utah, too, and Montana further valuable discoveries are reported, and an instance in Montana of important gold diggings, from which three men took out over 300 pounds of gold in less than four months, using only a hollow log for a sluice box.

The establishment, in all the mining districts, of concentrating and smelting works, which purchase ores from those miners who have not the means for erecting reduction works of their own, or whose knowledge of the art is imperfect, has everywhere given great impetus to the mining interests; and as the system grows in favor and the interests are better understood and adjusted, as they must soon be under competition, it will be found, we think, that this division of labor will add profit and safety to mining operations.

THE BOSTON WHITTLING SCHOOLS.

Formerly all American schools were whittling schools; but the art was practiced surreptitiously, the soft pine desks and benches furnishing the only whittling material. With the advent of highly finished hard wood school furniture, all jacknife practice in school was rigorously suppressed; and for a generation or so the art has fallen into decadence. It has revived, however, under improved conditions, the natural spirit of constructiveness—usually called destructiveness—incident to boyhood, being made the basis of systematic training of the most enjoyable and useful sort.

The pioneer institution is the Boston Whittling School, a private enterprise housed by the city. The school-room has been fitted up with work benches, divided into four foot sections, and each boy is furnished with such tools as he may need. Thirty two were admitted the first year, their ages ranging from twelve to sixteen. The school report says that perhaps twelve of them had received some instruction in the use of the jig saw and knife, but none had had any previous training in wood carving or the use of the chisel. There were more applicants for admission to the school than could be received. If any boy was absent two successive evenings, his place was taken by another. A rank list was kept and pasted on the wall, and each boy knew how his work was estimated by consulting the list. A course of twenty-four lessons in wood carving was prepared with special reference to secure the greatest amount of instruction with the least expenditure for tools and material. It was not designed to make finished workmen in wood carving, but to take advantage of the natural inclination toward handicraft, the Yankee taste for whittling which belongs to most boys, and to develop it and guide it to useful applications.

The experience of the founders leads them to the belief "that it would be easy to establish, in connection with all our grammar schools for boys, an annex for elementary instruction in the use of the half dozen universal tools, *i. e.*, the hammer, plane, saw, chisel, file, and square. Three or four hours a week for one year only of the grammar school course would be enough to give the boys that intimacy with tools and that encouragement to the inborn inclination to handicraft, and that guidance in its use, for want of which so many young men now drift into overcrowded and uncongenial occupations, or lapse into idleness and vice."

Northern and Central Europe have been doing this or similar work for years; and such teaching has done very much to hasten the industrial development of the countries that have tried it.

THE RESTORATION OF CUBA.

An official decree, dated September 21, provides that, from the date named, "All mules, horses, cows, and oxen, and all machinery and implements for agricultural purposes, comprised in articles 231 and 614 of the Custom-house tariff sheet, imported into ports of the provinces of Puerto-Principe and Santiago de Cuba, shall enter duty free for the term of one year. The term may be extended to another year according to circumstances. Said animals and goods can be imported from any country, and under any flag."

The ports designated for importation are Nuevitas, Gibara, Baracoa, Santiago de Cuba, Guantanamo, Manzanillo, and Santa Cruz. The franchise is accorded only to the provinces mentioned, with the object of repairing the damage inflicted by the late insurrection. A provision of the decree prohibits the introduction of the animals and goods referred to into the other provinces of the island either by sea or land.

This decree gives signal emphasis to our recent remarks with regard to the present importance of Cuba as a field for American enterprise. Now that the new patent law of Spain offers abundant protection for novelties and new inventions on terms of great liberality to inventors and introducers, there is no reason why the United States should not secure and hold a large share of the growing Cuban trade. It will pay our inventors and manufacturers to occupy the field promptly.

OUR SEPTEMBER EXPORT EDITION.

The September issue of the SCIENTIFIC AMERICAN Export Edition presents by far the most comprehensive and varied array of valuable information and important trade announcements ever brought together in a trade journal. The table of contents embraces upward of two hundred articles bearing upon recent advances in the several departments of pure and applied science, notable events, productive industry and commercial enterprise; and is illustrated by upward of one hundred engravings. The advertising pages are not less instructive and valuable, including as they do the business announcements of nearly one hundred and fifty of our leading mercantile and manufacturing establishments, with two hundred and twenty-five engravings of approved machinery and the like.

The influence of such a periodical on the foreign trade of the country can scarcely be overestimated. The high value of its general contents, and its convenient and substantial form, insure its careful perusal and preservation; and its wide circulation makes it an efficient as well as worthy exponent of American industrial and commercial progress. It goes to every American Consulate, the natural resort of all in search of information in regard to American affairs. It also goes to, and is on file in, a multitude of foreign libraries and reading rooms, and the assembly rooms of scientific and industrial societies and boards of trade. And every steamer sailing from this port is furnished with copies for the instruction and entertainment of the passengers. The liberal use of its advertising pages by our enterprising manufacturers is sufficient proof of their appreciation of the facilities thus offered for reaching and interesting foreign buyers.

A REMARKABLE WASPS' NEST.

A few days ago the time ball on the Western Union Telegraph building in this city had to be replaced by a new one. The workmen, who went up to remove the old ball had no sooner begun their work when they suspended operations with surprising abruptness and unanimity. A colony of wasps had taken possession of the ball, and were quite unwilling to surrender their airy quarters. Indeed, it was with considerable difficulty that they were finally smoked out.

The surprising feature of the affair was not so much the unwillingness of the wasps to surrender their home as their taking up with it in the first place. When in position for its noon fall the ball rests at the top of a pole, 255 feet above the sidewalk; and, at the tick of twelve, drops 20 feet. That the wasps should have borne with this daily disturbance of their dwelling place is proof of their tenacity of purpose, to say the least. Whether their persistence was due to practical wisdom or to inherent stupidity is a question for Sir John Lubbock or Prof. Riley to decide.

THE AMERICAN PRIZES AT PARIS.

Although the American exhibitors at Paris were far too few in number to do complete justice to our country's industrial achievements, the proportion of prizes announced shows the display to have been fairly creditable so far as it went. Just how many those prizes are it will be impossible to say positively until the official list is published. The (Paris) *Continental Gazette*, of September 12, however, gives a classified list of American prizes—"unofficial, but to be depended on so far as it goes"—which contains the names of five hundred and twenty exhibitors. Eight of these were awarded grand prizes; ninety-seven received gold medals; one hundred and thirty, silver medals; one hundred and seventy-six, bronze medals; one hundred and eight were honorably mentioned; and three—the Pacific Coast Mineral Exhibit, the Oregon State Commission, and the United States Department of Agriculture—got diplomas of honor.

The full significance of these awards cannot be appreciated without a comparison of the numbers of American and other exhibitors in the several departments, so as to show the percentage of prize takers among them. That cannot yet be done; enough is known, however, to show that there has been no serious falling off in American progress, notwithstanding adverse times.

A New White Paint.

After some ten years of laborious and costly experiments, Mr. T. Griffiths, of Liverpool, has succeeded in producing a new mineral white by the aid of sulphide of zinc, which entirely eclipses white lead and the old zinc white (oxide of zinc), by having much more "body" or covering power and more permanent qualities than either of these, and, moreover, not being of a poisonous nature like white lead, does not affect the health of those who manufacture or those who use it. The white sulphide of zinc is precipitated, washed, calcined, levigated and dried, the product being the most perfect white pigment hitherto obtained.

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Co-operative Homes.

Mr. Joel A. H. Ellis, superintendent of a co-operative household in Ionia, Fairfax Co., Va., offers, in the *American Socialist*, the following argument in favor of that style of economizing expenses. The one fatal defect in the plan would appear to be the impossibility of getting ordinary men and women to live together peaceably under such relations for any length of time. However, the experiment may be well worth trying to those who care to make it. Mr. Ellis says:

"The very large saving that may be made in supplying people with homes and a livelihood by means of co-operation is not well understood. It can be made to reduce the cost of a home and the expenses of living fully one half. To illustrate how this may be done, suppose we have three hundred people to provide with a home. If we divide them into families of five persons each, we shall have sixty families, and each of them will require a dwelling, a set of furniture, and a housekeeper. If we keep them in one large family, they will require only one large dwelling instead of sixty small ones. This large house will cost twenty thousand dollars. Sixty small ones of similar quality would cost one thousand dollars each, or sixty thousand in all. The small families would require sixty cooking stoves with furniture at a cost of twenty-five dollars each—fifteen hundred dollars in all; while the large family would do their cooking with two large ranges and a brick oven that cost only five hundred dollars. The furniture in each of the sixty small parlors would cost at least one hundred dollars—six thousand dollars for them all. The large family would need only three parlors, which could be suitably furnished for one thousand dollars. A sewing machine for each small family at thirty dollars each would cost eighteen hundred dollars. Six such machines would do all the work for the large family, and would cost only one hundred and eighty dollars. To furnish each of the small dwellings with a piano, if they should indulge in such a luxury, would cost, at three hundred dollars each, eighteen thousand dollars; while a piano, an organ, and the instruments for a band would supply the large family with all the music they would desire at a cost not exceeding eighteen hundred dollars. To supply each of the small families with a single weekly newspaper, at two dollars each, would cost one hundred and twenty dollars. This sum would place in the reading-room of the large family, five daily papers, twenty weeklies, and ten monthly magazines. The money required to supply the small families with the fixtures with which to do their family washing would furnish the large family with a well-appointed steam laundry, in which their work of this kind could be done with one fourth the labor required to do it by hand. The time of the sixty housekeepers for the small families would be worth, including board, $4 per week—$208 a year for each family, or $12,480 for them all; while in the large family, with their superior facilities for doing their housework, thirty women would be able to do it much better and easier than sixty could do that of the small families, and we should save $6,240 a year in the expense of doing our housekeeping, and have it much better done. The large family, by buying their supplies at wholesale in quantities, would save at least fifteen per cent of their cost when bought at retail by the small families.

"These examples are sufficient to convince any practical, thinking person that the saving which may be made by living in well organized co-operative homes is so large that none but the rich can afford to live in any other in times like these; that the amount which may be saved by introducing this style of living is so large that it would soon make the poor rich—so large that those who did not adopt it could not compete successfully in any business with those who did, because their expenses would be so much larger. The time has arrived when this method of living must be adopted to relieve the working class from their present distress."

Mr. Ellis says that a co-operative home has been organized at Ionia on this plan; but he gives no particulars with regard to its inner life and organization. If it comprises a congress of distinct monogamic families in one household, and is harmonious and flourishing, the experiment is a valuable one.

Keep Your Cement in the Dark.

Dr. Heintzel thinks that the influence of light upon cement has not hitherto been sufficiently considered. He instituted some experiments upon a quantity of cement, which he divided into three parcels, exposing parcel A to the air and full light; B to the air and diffused light; and secluding C in darkness from the air.

After six months he found that A made a weak mortar by absorbing 38 per cent of its weight in water, and it had become crumbly; B, with 33 1-3 per cent of water, made a mortar which was too adhesive to the trowel, and it yielded up none of its water; C, with 33 1-3 per cent of water, made an excellent mortar, easily stirred and flowing, and it relinquished some of its water. After setting for twenty-eight days the relative strength was: A, 3; B, 37·9; C, 44·6.

Remedy for Trichina.

Dr. Rohde relates, in the *Berliner Klin. Woch.*, a case of trichinosis in which severe bleeding of the nose occurred, and in which he prescribed extract of secale cornutum as a styptic. The hemorrhage was immediately arrested, and with this rapid improvement of the general symptoms also occurred. This result led him to prescribe ergot in other cases of the disease; and in all instances distinct improvement followed. He believes, therefore, that we have, perhaps, in ergotin, a means of treatment which, without having any marked effect on the human economy, may prove fatal to trichina and their offspring.

NEW ELECTRICAL DIAPASON.

[*Continued from first page.*)

the spring connecting pieces that project from the back of the vibratory tongues.

The holes in the spring connecting pieces are made larger than the needle, and pieces of thin leather are attached to the connecting pieces to form a yielding bearing for the needle. To the outer end of the needle is secured a small concave mirror, in front of which a small plano-convex lens is supported by a jointed arm projecting from the main frame of the instrument.

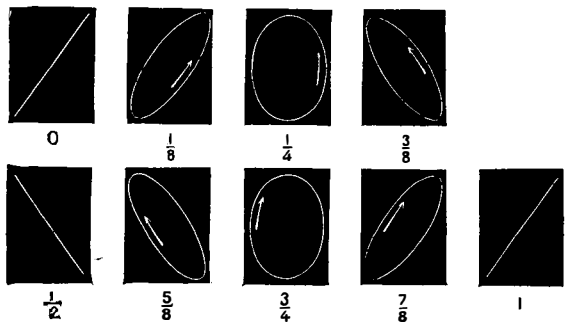

FIG. 3.

A beam of parallel rays being thrown on the concave mirror from a lantern or *porte lumière*, and the vibratory tongues being set in operation, a figure will appear upon the screen on which the instrument is focused, which will be the resultant of the two rectangular vibratory motions. This figure depends on the persistence of visual sensations on the retina, for it is really due to the rapid movement of the light spot which is seen when the tongues are at rest. The figure may be varied by moving the slide so that any possible combination of tones within the compass of one and one half octave may be produced. It is interesting to observe the change of figure resulting from the slightest alteration in the adjustment of the slides, or from the change of phase resulting from an alteration in the adjustment of the contact screws. The tones that accompany the figures are full

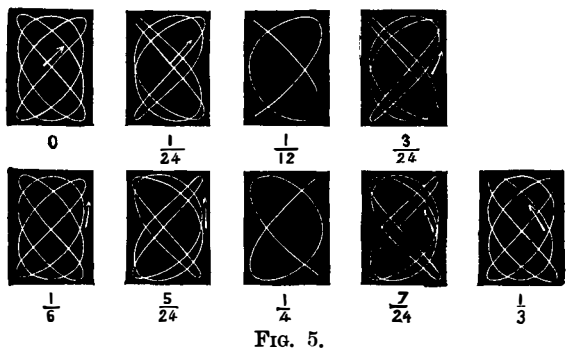

FIG. 5.

and deep, especially if the instrument be mounted on a sounding board. The effect known to musicians by the name of "beat" can be produced by this instrument, so that they may not only be heard with distinctness, but may also be seen.

If only one tongue vibrates a straight line will appear on the screen, which will be inclined at an angle of 45° from the horizontal. The line produced by one of the tongues forms a right angle with the line produced by the other, and when both tongues vibrate simultaneously the two motions combine, and the reflected pencil describes a more or less complex curve, the form of which depends on the number of vibrations of the two tuning forks in a given time.

Fig. 3 shows the luminous image on the screen when the tongues vibrate in unison, and the fractions below each figure indicate the difference of phase between them. The curve retains its form when the tongues are in unison, but when they are not quite in unison the initial difference of phase is not preserved, and the curve passes through all its variations. Fig. 4 represents the different appearances of the luminous image when the difference between the vibratory tongues is an octave; and Fig. 5 represents curves when the number of vibrations are as 3 : 4. The loops along the vertical and horizontal edges express the ratio of the combined vibrations. The variety of figures that may be produced by this instrument is endless.

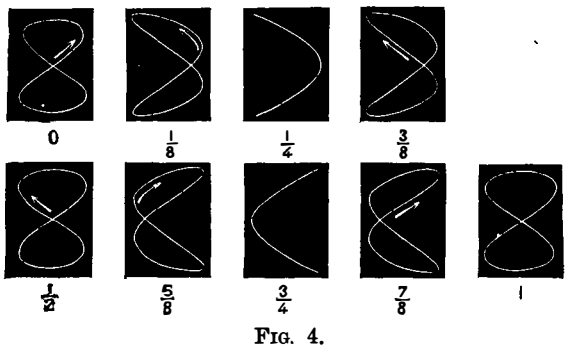

FIG. 4.

When sunlight is employed to project the figures the mirror may be plain and very small, and the lens may be dispensed with. The figures, when viewed directly in a plain mirror of one inch diameter, appear as wires of burnished gold interwoven in a most complicated and beautiful manner.

LAMPBLACK.

One of the largest establishments for the manufacture of lampblack is at Petrolia, Pa. The method of production is remarkable. The flames of several thousands of gas jets are made to impinge against sheets of slate, on which the smoke or fine carbon is deposited, just as a piece of glass is smoked when held over a candle flame. When a sufficient deposit of the smoke has formed on the slates, it is scraped off, packed, and sent to market.

The gas which supplies this lampblack comes from the ground near the works. Besides its oil wells, Petrolia is celebrated for its wonderful gas wells, which furnish inexhaustible supplies of fuel for steam engines, heating, cooking, etc.

From Petrolia to Pittsburg there is an oil pipe line by which oil is driven to market by force pumps, operated by steam power; the boilers being heated by gas supplied by one of the gas wells. We almost wonder that the Petrolia people do not introduce the use of gas engines and thus dispense with the use of steam boilers.

Improvement in Rifle Shooting.

The scores made at Creedmoor, Saturday, September 21, in the long-range match for the Wimbledon Cup, seem to show that the limit of skill in shooting and rifle making is not yet reached. Before many years, an unbroken score of thirty bull's eyes at 1,000 yards will have to be credited to some American rifleman.

The Wimbledon Cup was won in England by Major Fulton with a score of 133 out of 150, and subsequently carried off at Creedmoor, by Allen and Dudley Selph, with scores of 139 and 137. This year Frank Hyde has it with a wonderful score—143 out of 150 at 1,000 yards; while Sumner and Gray, with scores of 142 and 141 respectively, repeat Millner's famous exploit of 15 consecutive bull's eyes at the long range, and ten riflemen run over Fulton's English score. When it comes to team shooting, fours from Massachusetts and New York make a total score of 1,681, which is 52 points ahead of the best score made by the British eight in the International match.

Diamonds in China.

Mr. Fauvel, of Chefoo, communicates in the *North China Herald* some interesting facts concerning his researches into the mineral wealth of the district of Shantung and the curious means of collecting small diamonds by the natives.

"These diamonds," he says, "varying in size from a millet seed to a pin's head, are procured from the glaziers, who buy them at the large fairs held every year at Chüchow, Laichow-fu, and Hwang-hsien. They are not to be found in shops, and are packed in quills. The manner of finding these stones is very curious. Men with thick straw shoes on go walking about in the diamantiferous sands of the valleys and streams of the diamond mountains, Chinkangling, some fifteen miles south-east of Yichow-fu. The diamonds, which are ragged and pointed, penetrate the straw and remain there. The shoes are then collected in great numbers and burnt, the diamonds being searched for in the ashes. As is the case with amethysts and rock crystal in the Lao Shan, the priests of the temples in the Chinkang-ling are the principal dealers."

Mr. Fauvel further mentions that a diamond as large as a pea had been brought to Chefoo, and sold to a mandarin there.

The Grand Canal of China.

FOR six or eight hundred years the Grand Canal, crossing the great plain of Northern China, from Pekin, in the north, to Hangchow, in the south, has been the chief line of communication and commerce between the capital and the southern portions of the Chinese Empire. The canal proper is more than six hundred miles long, and, with its branches, is said to supply two thousand miles of water-way and the means for irrigating and reclaiming many thousand square miles of thickly peopled country. During recent years, however, the vast sums appropriated for the management and repair of the Grand Canal have been so largely absorbed by dishonest officials that the canal has become practically unfit for commerce in many parts; while the estimated cost of putting it in good condition is so hopelessly beyond the capacity of an empire impoverished by war, famine, and official rapacity, that the Imperial Government are seriously considering the propriety of abandoning the canal entirely. For the first time since the canal was built the food supplies from the south for the support of the capital (and for the relief of the famished-stricken regions to the north and west) have this year been forwarded by sea—a much speedier and more economical route, no doubt; still, for the great plain and its millions of inhabitants, the canal is a practical necessity, and, to let it go to further destruction, will seriously endanger their prosperity, if not their lives.

Punch says that a Yankee baby will crawl out of his cradle, take a survey of it, invent an improvement, and apply for a patent before he is six months old.

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HASTIE'S WATER ENGINE.

In obtaining motive power from the pressure of water, either from gravitation or by means of the accumulator, it has hitherto been impossible to employ it with economy on account of its non-elastic nature, which prevents its being used expansively, like steam or air, the result being that all hydraulic engines use as much water when running idle as when working at their full power; in addition, as the pressure in town mains varies a good deal during working hours, any margin which the maker must allow in constructing the engine, to insure its being sufficient for its work at the minimum pressure, is a direct loss, as water will be wasted over and above the effect produced all the time the machine is at work, to the amount of this margin, with the result that where the work is also variable, a loss of water to the extent of from 60 to 70 per cent often takes place. This difficulty is overcome by a novel arrangement invented by Mr. John Hastie, of the firm of John Hastie & Co., Kilblain Engine Works, Greenock, who has constructed an engine with simple automatic appliances, so that the amount of water used is in direct proportion to the amount of work done. If the engine is running idle, water is only used sufficent to overcome its friction, and when more work is thrown on, extra water is used corresponding with that work. This is accomplished by making the stroke of piston of variable length, and the mechanism to accomplish this is so arranged that the engine itself makes the necessary adjustment of stroke for the power required, without assistance from and independently of, any attendant.

Half a dozen engines on this principle can be seen practically at work in Greenock, and tested as to the sensitiveness of the automatic arrangement, and Messrs. Hastie have several more in course of construction. These engines are adapted for working hoists and for driving all kinds of machinery.

The accompanying drawings give details of a hydraulic hoist constructed on this principle, and the working of which will be understood from the following description: A, Fig. 1, is the inlet pipe or passage which communicates with the smaller end of cock, B, Fig. 2; this cock, wrought by the handle, C, controls the working of the hoist, being so constructed that it acts as a reversing valve when the lever is at the extreme positions, and in the center position as a brake; in the latter position both parts of the working cylinders being opened in communication with the exhaust,

FIG. 3.

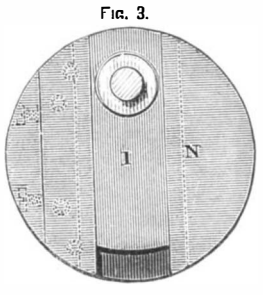
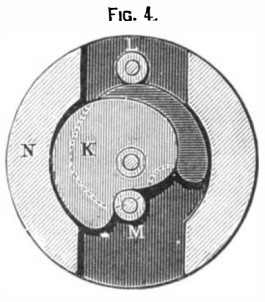
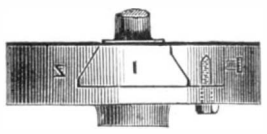


FIG. 4.



U, Fig. 1, the pipe of which is constructed with a bend to contain at least as much water as will fill the three cylinders. This makes a most efficient brake. A maximum velocity for lowering can be fixed, and no water requires to be drawn from the main for this purpose. Two passages of communication are formed in the framing between the cock, B, and each of the cylinders, D, the termination of these passages being shown at E, in Fig. 1. The oscillation of the bottoms of the cylinders is utilized to act instead of valves in distributing the water. The cylinders are held in position and adjusted by the eye bolts, F, Fig. 2. The rams, G, are of the usual construction, fitted with neck leathers, and acting direct on the crank pin, H; this pin is formed on a sliding frame, I, Figs. 1 and 2, which frame effects the necessary adjustment of the stroke; it is formed in two pieces, an outer and an inner, bolted together at the ends, and between these is a space in which the double cam, K, works; the outer plate has a small steel roller, L, working on outer half of the cam, and the inner plate a similar roller, M, working on inner half of the cam, Figs. 4 and 5. The disk, N, is keyed on the hollow shaft, O, and the cam, K, on the barrel shaft, P, which is reduced to pass through the center of shaft, O. This latter shaft, O, has two snugs formed on it, to which chains, P, Fig. 6, are attached; the barrel shaft, P, has the spring case, S, keyed on it, which contains the two springs, T. The action of this part of the arrangement is as follows: When the engine is at rest the springs have just as much pressure on them as holds the roller against the inner part of the curve of the cam; this pressure is also sufficient to prevent any change in position of the crank pin, should the engine be running without weight. In the event of a weight being lifted, the springs become compressed in proportion to the amount of this weight; the compression of the springs alters the relative position of the shafts, O and P, which cause the rollers, E, to move along the curve of the cam, at the same time shifting the position of the sliding frame, I, and thus giving an increased stroke in proportion to the weight being lifted. On the weight being removed the tension of the springs causes the roller, M, working on the cam, to bring the frame and crank pin back to the inner position. Through this automatic variation of the stroke the water used is always in proportion to the work done. Mr. W. R. Kinipple, M. Inst. C. E., chief engineer to the Greenock Harbor Trustees, recently made a series of experiments with one of these engines made for the Greenock Infirmary, and attached to a hoist, the readings being made from a Siemens meter. The height of lift was 22 feet, and the pressure of water 100 lbs per square inch. The result was as follows:

FIG. 5.



Weight lifted 22 ft. high. cwts. qrs. lbs.	Average water used each lift.
3 3 7	10 Gallons.
5 2 17	14 "
6 2 17	16 "
7 2 17	17 "
8 2 17	20 "
9 2 17	21 "
10 2 17	22 "

In this particular hoist the lifting of the empty chain took about 7 gallons. In the case of hoists wrought by high pressure, in connection with an accumulator, the spring shown in the drawing can be dispensed with and two water rams employed instead; in this latter arrangement the rams referred to are connected with a supply pipe through the center of the shaft, P, which is made hollow for this purpose. A similar action is obtained by the chain, R, being wound on cams instead of round the shaft, as in the case of the springs. When engines are employed for driving power apart from a hoist, they act as their own governor, as the variation of the stroke causes a variation of the opening of ports, and in this way a steady speed of engine is obtained, whether running idle or at its full load, and a saving of water is also effected by the prevention of "racing" when the work is thrown off. We take our illustration from the *Engineer*.

FIG. 1.

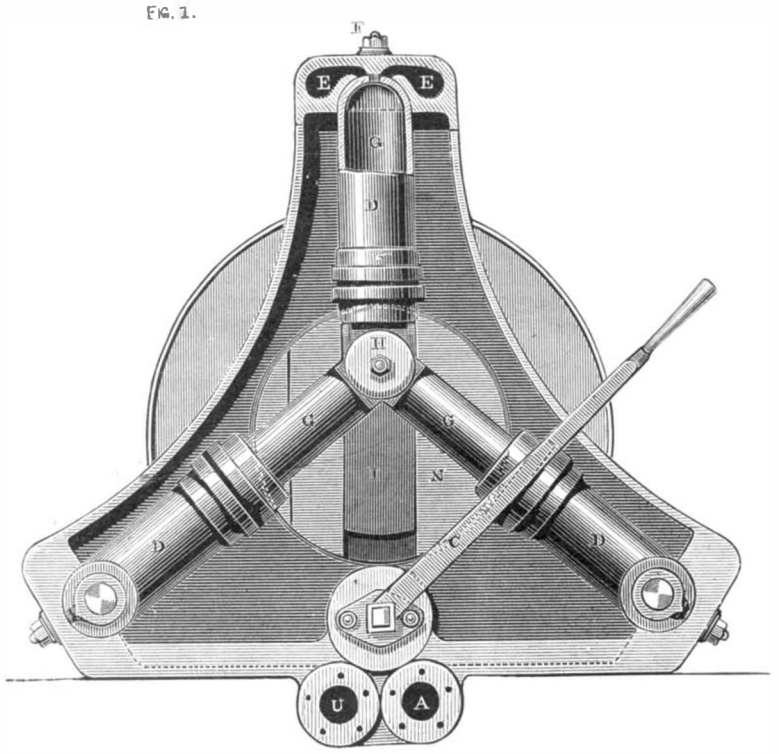
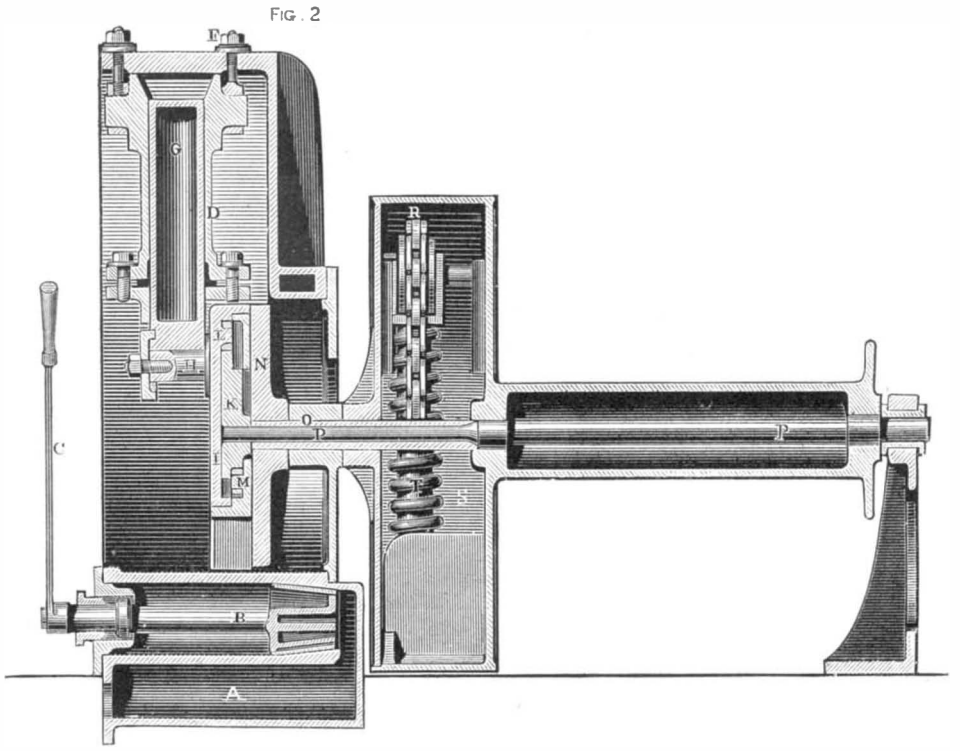


FIG. 2



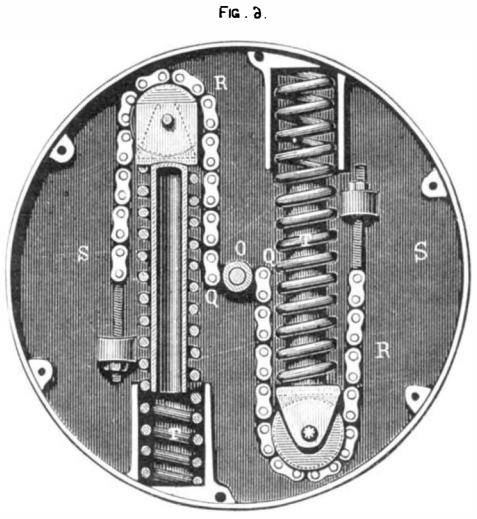
HASTIE'S WATER ENGINE.

Heating by Hot Water.

The peculiarity of Mr. Hearn's system, of Liverpool, is the small size of the heating tubes, which consist of lengths of the best Staffordshire wrought iron piping—$1\frac{5}{16}$ inch external diameter, $\frac{7}{8}$ inch bore—connected by means of sockets having right and left hand threads. The sharp conical end of one pipe is brought in contact with the flattened end of another by simply turning the socket, which, running on both threads at the same time, forces the one into the other, thus making a perfectly solid metallic joint, stronger even than the pipe itself. A certain proportion, varying according to the temperature required, of the total quantity of piping used, is arranged in the form of a coil, and placed in an iron or brick furnace constructed for the purpose. This circle of piping varies in size according to the work to be done, from the small coil which may be placed in an ordinary office grate for the purpose of heating workshops or other offices adjoining or overhead, to the large apparatus, five feet long or more, which may be necessary to heat the various floors in a large mansion or extensive warehouse. The coil having been placed in the furnace in such a manner that the pipes themselves constitute the grate bars—and this, says the *Textile Manufacturer*, is the main improvement which has been made by Mr. Hearn—and connected with the pipes in the building, the endless circuit of pipes now formed is filled with water and tested with a hydraulic pump to a pressure of 3,000 lbs. to the square inch. Upon the application of heat the process speedily comes into operation. The water at the bottom, catching the heat, ascends by virtue of a well known law to the top of the circulation; the cold portions at the same time coming down to supply the place of what has ascended. In time the whole of the water from the top down to the bottom is heated, and the process is then in full operation, after which it is only necessary to keep up a fire sufficient to maintain the heat required.

As the expansion of the water increases with the increased temperature, special provision is made for it by fixing at the highest part of the apparatus, and near to the fill pipe, an expansion tube about three inches in diameter, which is hermetically sealed. With the exception of the necessary supply of fuel to the furnace, the only other attention required is to see that the apparatus is supplied with about two pints of water once a year or so. Any kind of fuel can be burned, but coke or non-bituminous coal is used in preference; and by means of control in connection with the furnace door and damper in the flue the heat can be regulated with great nicety. So much for a single circuit, or, as

FIG. 3.



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it is technically termed, a "circulation." For manufacturing purposes, and for heating large warehouses, it is usual to have several independent circuits of piping or circulations, either laid side by side, a few inches apart, where high temperatures are required for drying purposes, or, as when used for warming large buildings, different circulations are laid to different rooms or floors, the circuits, however, all returning to the same furnace. Experience has shown that it is not advisable to have a much greater length of piping in one circulation than 500 feet; but although several apartments may be warmed in this circuit, it must not be inferred that they must necessarily be heated, whether desired or not; in fact, it is easy, by the mere turning of a cock handle, to cut off any one or all of the rooms. Each circuit, as already mentioned, is hermetically sealed, and as the steam which fills the expansion pipe increases in pressure, the temperature of the pipe rises proportionately above that of boiling water, so that while the water is just beginning to boil, the temperature of the pipe is 212° Fah.; if by vigorous firing the pressure reaches, say, 185 lbs. to the square inch, the temperature exceeds 380° Fah., and higher for greater pressures By regulating the fire, therefore, the degree of heat is easily under command, and the high temperatures which may thus be obtained will be understood when it is explained that the system has found extended use for heating bakers' ovens, and, although not so widely, for core drying stoves in foundries, for which purpose we can commend it to the notice of our engineering readers, leaving them to recognize the advantages it possesses over the sooty, ill lighted dungeons they now employ, and of which we have painful recollection from the days of our apprenticeship.

We may say that quite recently we inspected an apparatus supplied by Mr. Hearn at work under very trying conditions in the albumen works of Mr. W. H. King, St. Andrew street, Brownlow hill, Liverpool. Albumen, so largely used by calico printers, it should be explained, is obtained from the colorless liquid called serum, which is collected by allowing clotted blood to drain upon perforated trays. Serum consists of water holding in solution about nine to twelve per cent of albumen, and to obtain the latter the water must be removed by evaporation. Now, albumen coagulates at about 150° Fah., and if the evaporation be carried on at this temperature, the coagulated product being insoluble is useless for the printer, while on the other hand, if the concentration be performed at a temperature much below 120° Fah., the albumen tends to decompose, evolving odors more pungent than pleasant, and the inspector of nuisances makes it his business to visit the establishment.

The great nicety of the operation will now be easily understood. The serum is placed to a depth of about half an inch in shallow trays disposed on shelves in the heated chambers, and twenty-four hours suffice to obtain the albumen as a thin scale on the bottom of the tins. Mr. King, having had the apparatus for some time, is perfectly satisfied with its performances. As arranged at his place it consists of four circulations, placed in two chambers; the furnace is a trifling affair, and but little longer than our desk.

En passant, as of interest to calico printers, we may say that Mr. King is placing albumen in the market in a new form, namely, in solution, and of a very convenient degree of concentration—about four pounds to the gallon, or say 20° to 22° Twaddel, and bleached to any degree required. The advantages of this are that it saves the printer the risk of finding solid impurities when he dissolves, and the producer less time for concentration, as it is not evaporated to dryness, but stopped off at the proper point, and also less risk of coagulation.

Artificial Diamonds.

The sons of the late Dr. Gannal, in looking over the documents left by their father, came across the draught of a paper which he had presented to the French Academy of Sciences in 1828, on the subject of the artificial production of the diamond. This paper was referred to MM. Vauquelin and Chevreul, and nothing further was ever heard of it. The MM. Gannal now send the document to the Academy, believing it to be their duty to bring to light the now forgotten researches of their father.

It seems that in making some experiments with carburet of sulphur, the idea occurred to Dr. Gannal that the carbon might be separated from it in crystalline form. He, therefore, took a certain quantity of the carburet, poured a little water on the top of it, and then carefully introduced some stick phosphorus. The latter immediately dissolved, with the formation of three separate layers, phosphorus at the bottom, carburet of sulphur in the middle, and water at the top. After a time he noticed that a sort of film was formed between the two latter layers, and that when exposed to sunlight it was iridescent. After the experiment had been in progress three months, a sudden fall in the temperature froze the water, split the glass, and the contents were thus lost. He again began his experiments, but as each one required six months to carry out, and as the numerous accidents to which they were liable continually interfered with their success, he finally abandoned his efforts. However, in the course of his experiments he had been able to procure some minute crystals, which he submitted to an eminent jeweler, who tested them by the microscope and other means, and decided that they had the true fire, water and hardness of the diamond; moreover, on being subjected to the blowpipe, they left no ash. He concludes his memoir as follows: "I believe that I can now announce that the greatest step is made toward the solution of the problem of making diamonds, in all respects similar to those nature has disseminated in India and Brazil." The complement of this discovery will do great honor to modern chemistry. The MM. Gannal call attention to the fact that there is no analogy whatever between the products obtained by their father and the pretended diamonds of M. Cagniard, of Latour, the latter being nothing more than silicates.

REYNIER'S NEW ELECTRIC LAMP.

The chief difficulty to be overcome in an electric lamp is a means of supplying the wasting away of the luminous conductors—a wasting which takes place very rapidly, even when inclosed, in consequence of the volatilization and disintegration of the carbon pencils, and which is greatly accelerated in free air, through the quick combustion of the incandescent carbon.

Fig. 1.

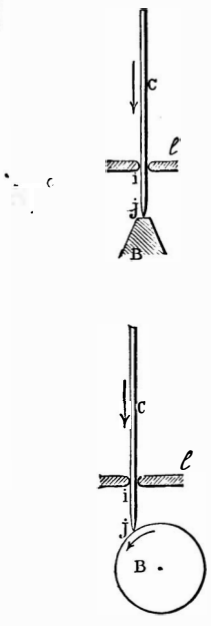


Fig. 2.

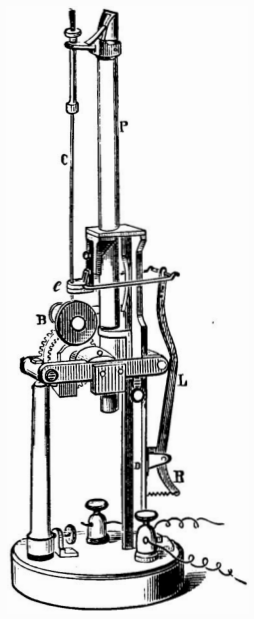
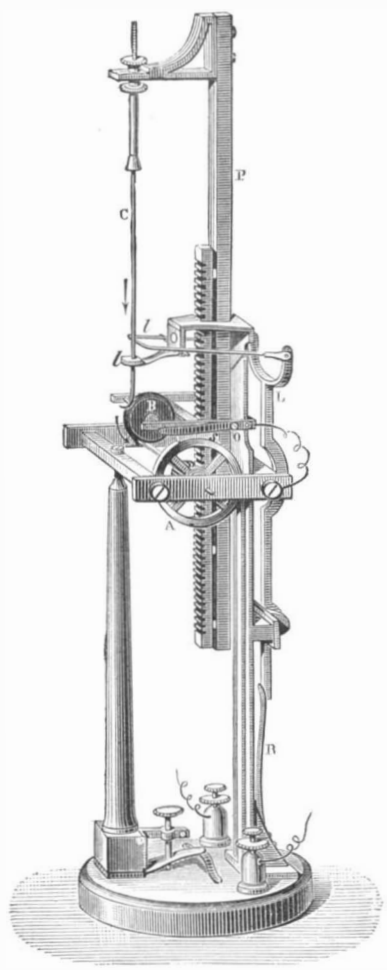


Fig. 3.

In the various systems of electric lamps hitherto proposed, the renewal of the carbons takes place as follows: The incandescent pencil, fixed in its support, remains in place until broken by being worn out, then the light is extinguished; the electric current now passes suddenly from this carbon to another, which wears out and breaks in its turn, and so on. This method presents many inconveniences; there is an interruption of the current with an extinction of the light at every break of the carbon; the luminous intensity varies continually with the gradual thinning of the carbon pencil; the conductor furnishes its maximum of light only at the moment when it is about to break; and, finally, the devices proposed can scarcely operate well except when inclosed. In the new system, described in this article, the renewal of the carbon is progressive. The pencil, incandescent at one part of its length, proceeds almost continuously, until every portion that can be utilized is completely used up. This system will operate in free air. This is the principle involved.

Fig. 4.



A cylindrical or prismatic pencil of carbon, C (Fig. 1), is traversed between *i* and *j* by an electric current (continuous or alternate) sufficiently intense to render it incandescent in this portion. The current enters or passes out through the contact, *l*, it passes out or enters through the contact, B. The contact, *l* (which is elastic), presses against the carbon laterally; the contact, B, touches it at the extremity. Under these conditions, the carbon wears away at its extremity faster than at any other point, and tends to shorten. Consequently if the carbon, C, is urged forward continuously in the direction of the arrow, it will advance gradually, in proportion as it wastes away, sliding through the lateral contact, *l*, in such a way as to continually touch the terminal contact, B. The heat developed by the passage of the current through the pencil is greatly increased by the combustion of the carbon.

In practice, the fixed contact is replaced by a revolving contact, B (Fig. 2), which carries off the ashes of the carbon. The rotation of the terminal contact is made to depend on the progressive movement of the carbon; so that the latter acts as a check on the motive mechanism of the lamp.

The principle of this new system of lamps having been established, it became an easy matter, of course, to devise a simple apparatus to put it into execution.

A mere inspection of the model (Fig. 3), which was exhibited by the inventor, M. Emile Reynier, before the Société de Physique, will serve to show how it operates. The progression of the carbon, C (Fig. 3), and the rotation of the terminal contact, B, are obtained by the descent of the heavy rod, P. To wind up the lamp it is only necessary to raise this column. The carbon pencil is put in place without any adjustment.

The luminous point remains fixed in one place, a very important matter, and especially so in optical experiments. This apparatus gives a clear white light with four Bunsen elements. With more powerful electric sources, several lamps may be illuminated by this system, and thus a subdivision of the electric light may be obtained. With a battery of 36 elements the inventor has operated four lamps, in tension, on a single circuit; these he extinguished and relighted at pleasure, several times; each of the four lamps he extinguished and relighted separately, the other three continuing to shine. Light has been obtained in one of these lamps by the current from a small laboratory Gramme machine. Finally, a beautiful light has been obtained with a Plante battery of 3 elements (secondary). These experiments may be considered as a step toward the application of the electric light to domestic uses.

Fig. 4 shows a newer mechanical arrangement of one of these lamps, which has not been hitherto published. In this device the rotation of the revolving contact is obtained by the pressure of the carbon on the circumference of the disk. By this means the end of the incandescent pencil never leaves the revolving contact, thus avoiding any cause for inequality in the light. The check, which is indispensable, is obtained as follows:

The wheel, B, is borne at the extremity of a lever which articulates at O. The pressure exercised by the carbon on the wheel, B, causes the shoe, S, to rub on the felly of a smooth wheel, A, which is turned by the descent of the heavy rod, P, through the medium of its rack and pinion, *a*. According as the point of the luminous conductor presses more or less on the wheel, B, the check prevents to a greater or less degree the descent of the column, P, the advance of which is imperceptible.

New Mechanical Inventions.

Mr. Lyman B. Howland, of Lakeville, Mass., has patented an improved Picking Motion for Looms, which consists in a peculiar arrangement of cams, levers, springs, and yielding connecting rods, whereby the shuttle is driven at a uniform speed, irrespective of the speed of the loom.

Mr. Joseph Taylor, of New Orleans, La., has patented an improved Machine for Sandpapering or Polishing the surface of blind slats or other articles. The inventor employs a polishing wheel or drum rotated by competent power, and having its inner surface lined with sand or emery paper or other polishing substance. The articles to be polished are placed against a guide or rest next to the polishing surface, and moved back and forth by hand to polish them. An exhaust blower is connected with the polishing wheel to draw away the dust and particles removed by the wheel from the surface under operation.

Mr. Francis J. Ribble, of Campbellsport, Wis., has patented an improved Ratchet Wheel and Pawl Mechanism for rotating shafts by treadle power. This consists in a ratchet wheel and pawl carrier upon the driving shaft, operated by connections from a treadle to cause the pawl to turn the ratchet wheel and driving shaft, and then return the pawl to the starting point. A cord is unwound from a spool to move the pawl and ratchet wheel by winding the cord upon a wheel propelled by the treadle, and the ratchet is returned by the reaction of a spring acting through a cord on a second spool to return the parts to their normal position.

An improvement in Steam Gauges has been patented by Mr. Charles R. Vaillant, of Mobile, Ala. This relates to certain improvements the object of which is to enable the pressure of steam in a boiler to be indicated so as to be seen simultaneously by two or more persons located at different points.

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Exhibition of the Massachusetts Charitable Mechanic Association, Boston, Mass.

It is four years since the Massachusetts Charitable Mechanic Association held their last industrial exhibition. The former triennial expositions were held at Faneuil Hall, Boston, but for the present exhibit, now open, special buildings have been erected that cover an area of two and a half acres, in close proximity to the depot of the Boston and Providence Railroad. The main building is constructed of wood, but the art building is of corrugated iron.

The exhibition as a whole is one of interest. The most prominent feature is the department of fine arts, where there is a good exhibition of oil and water color paintings, crayons, engravings, ceramics, statuary, architectural drawings, chromos, etc.; in the disposition of these good judgment has been shown. In the machinery department, though somewhat limited, there are some machines and mechanical contrivances in operation that for beauty of design and practical utility attract more than ordinary attention. Among these are the boilers and elevators by the Whittier Machine Company; a horizontal engine that drives the machinery in the main building, by C. H. Brown & Co., of Fitchburg, Mass.; looms by L. J. Knowles & Brother, Worcester, Mass.; and cotton spinning machinery by Davis & Furber, North Andover, Mass.

The boilers referred to are two in number, and furnish steam for the building. They are 54 inches in diameter, 16 feet long. Each boiler has 42 tubes, 4 ins. diameter and 15 feet long. The shell is 5-16 inch thick, heads 7-16 inch thick. They are made of homogeneous steel plate from the Cleveland Rolling Mill Co., Cleveland, Ohio. These boilers are set with the Jarvis Furnace setting, and attract much attention, on account of the remarkable economy of fuel attained. After careful examination for three hours we found that steam at 60 lbs. pressure was maintained with fuel 80 per cent. of which was screenings and 20 per cent. of soft coal. At another stage of firing, pomace and screenings were used. There was no artificial draught, beyond the ordinary smokestack, which in this case is 55 feet high, and yet a bright, intensely hot fire was the result. The peculiar construction of the Jarvis Patent Gas-Consuming Furnace has already been fully described in this journal, and to this description we refer all who are interested.

The horizontal engine driving the machinery is one of the finest ever made by the manufacturers, and is admirable in workmanship, efficiency, and high finish. It is rated at 80 horse power. Cylinder is 16 inches diameter, stroke 42 inches. Band driving pulley is 12 feet diameter, with a face of 25 inches. The engine has Brown's variable cut-off, and makes 60 revolutions per minute.

The elevators, by the Whittier Machine Co., of Boston, Mass., are three in number, consisting of one steam and one hydraulic passenger elevator and one steam freight elevator. These are all in constant operation. The steam elevators are technically termed "double screw hoisting machines," and are operated by double upright reversing engines without links. The double upright hydraulic elevator is capable of lifting 3,000 lbs. at a time by the large cylinder, and 1,500 lbs. at a time by the small cylinder. These cylinders are made from the best loam castings, and fitted with the necessary piston, crosshead, guides for the crosshead, sheaves, and the inlet and outlet valves for the entrance and discharge of the water. The sheaves are grooved and bored in a lathe to insure accuracy of form. The piston, crosshead, and the sheaves, etc., attached to them, are counter-balanced by iron weights to render the consumption of water as small as possible, and to prevent the ropes from leaving their places on the sheaves, should the car in its descent meet an obstacle carelessly left in its path. There are two hoisting ropes, a shipping rope, and two counter-weight ropes, all of iron wire. The frame of the car or platform is of ash, well ironed. Its crosshead is ash lined with plate iron, and fitted with Whittier's Patent Equalizing Sheave. The safety apparatus is so arranged that the breakage of either hoisting rope will operate it. The finish of the car is paneled and of good design. The car has an electric annunciator and a gas bracket with rubber tubing to convey the gas to it. The size of the car is about 6 feet square. The machine has a register to record the amount of water used. It has also an automatic stop, independent of the shipping rope, to stop it when the car reaches the upper landing, and specially designed to operate when the shipping rope may get deranged or broken, and to protect the machine and load from the injury which would without it be likely to happen. The machine also has the shipping rope arranged to stop it automatically when the car reaches the upper or lower landings.

The Economy of Good Workmanship and Material.

Five years ago a steam engine, six boilers and some elevating machinery were put into operation at the Boston Post Office. The engine, having the Rider cut off and a Norton ejector, a cylinder 14 inches in diameter, a stroke of 28 inches, a driving band pulley 8 feet in diameter and 18 inches face, working at low pressure of 25 lbs. per square inch, and making 50 revolutions per minute, has not needed any repairs. Keys and screws have been adjusted, but for repairs there has not been an expenditure of one dollar. So with the boilers—48 inches in diameter, with shells of steel $\frac{5}{16}$ inch thick, each having 48 tubes, 3 inches diameter, and 15 feet in length—beyond careful cleaning, there have been no repairs. And yet this machinery for five years has been in operation, on an average, twenty-one hours out of the twenty-four, working efficiently and noiselessly, the admiration of engineers and all visitors. The engine and pumps are elaborately finished in the highest style of mechanical art. The engine, boilers, and elevator were constructed by the Whittier Machine Company, of Boston, Mass., and have been under the charge of Chief Engineer M. G. Wood. The same company have recently erected some fine machinery in the Orient Building, Wall street, New York.

Electric Lighting.

The advancement made of late in lighting by electricity is so full of promise, of such general interest and importance to the public, that we give, in order to call attention to some of its advantages, which are not generally understood, a brief extract from a report from M. Delahaye to the Industrial Society at Rouen, referring to the lighting by electricity at the works of M. Manchon, an extensive cloth manufacturer.

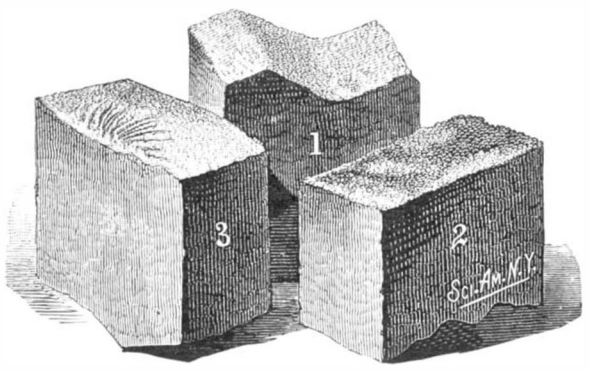
"On entering M. Manchon's factory one is favorably impressed by a striking sense of intense brightness, excited more by the nearly entire suppression of shadows than by the brightness even of the light which pervades the shed. The workmen are very well pleased with the light obtained. The foremen, who, no doubt, are best able to form a comparison between the two lights, since they never quit the building, do not hesitate to declare that the electric light is much superior to the gas light, and that the women, like themselves, are much less fatigued after the long hours by reason of the absence of the heat radiated from the gas-reflectors which were immediately over their heads. M. Manchon has also pointed out to me a considerable advantage in the new light, due to the well-known property of the electric light of not altering even the most delicate shades of color; the errors formerly fallen into by the workmen in renewing broken threads, or in refilling the shuttles, being thus prevented; the quality of the product is, in consequence, sensibly improved."

Comparative estimates of the cost for lighting on various systems might be given, from which the great advantage of the electric light over all other systems of lighting for equal powers would be shown.

Should electric lighting eventually supersede all other methods, as now seems very probable, it will, of course, seriously interfere with the consumption of coal and probably cause considerable reduction in its price, and will, happily, relieve the public from the too common oppressive monopolies of gas companies.

BAUER'S STEEL RESTORING AND REFINING COMPOUND.

Every one who has used steel tools sufficiently to become experienced as to their cutting capacity has discovered the



serious deterioration consequent to the least overheating in forging them, or the least defect in the quality of the steel. The use of burnt or inferior steel involves a serious loss of time and material.

Mechanics generally can form a fair estimate of the quality of steel from the appearance of its fracture, and readily detect the coarse granular appearance accompanying burned steel as well as the fine granular appearance common to inferior steel.

In Figs. 1, 2, and 3 are shown adjoining pieces of steel from the end of the same bar. Fig. 1 is a piece broken from the new bar. The bar was then burned, and the pieces, Fig. 2 and Fig. 3, broken off. Fig. 3 (one of the burned pieces) was then heated and quenched in a compound manufactured by the Steel Restorative Works, of 119 Greenwich avenue, New York city. The grain of the latter is, it will be seen, considerably finer than the original steel. Of this compound Joshua Rose, M. E., says: "I have used it on a tool previously burned, and cut cast iron at 38 feet per minute, taking a heavy cut and coarse feed. I have tried it on burned steel of which a thin spring was subsequently forged, and the results were equally satisfactory."

This compound is also used for annealing purposes, to remove the liability to warping or cracking, the steel being heated and then cooled in the compound, and then reheated and placed in sawdust.

A Queer Boat.

The Portland (Me.) *Argus* says that Captain R. H. Tucker, of Wiscasset, has lately launched a curious boat called "Air Propeller." It is a diamond shape, 90 feet long and 15 feet wide in center; has flat bottom, five masts, covered with very odd-shaped sails, which are three-sided, and every alternate one is placed point down instead of up; the rudder, and in fact every part of the boat, is different from those in use. Captain Tucker is experimenting on some new principles which he thinks may be better than those in use. He will also put a steam boiler in this boat, for the purpose of forcing air underneath, which will be the power used in calms.

Remarkable Earth Convulsions.

A correspondent of the *San Francisco Chronicle*, writing from Apia, Samoan Islands, under date of July 17, says that the most extraordinary convulsions of nature are taking place throughout the island groups of Southern Polynesia, and never in the history of those regions have these convulsions been so frequent as during the present year. There can be no doubt that raging fires of great vastness are now constantly active in the bowels of the earth all through these tropical latitudes, for daily new islands have been formed or old ones blotted out of sight, absorbed into the unknown by tremendous earthquakes. Scarcely a vessel arrives at Apia that does not bring the news of some such gigantic action of nature.

Captain Hassenberg, master of the brigantine Matutu, lately arrived at San Francisco from the Ellis group, and reported that the earth had been acting in a very strange and mysterious manner. The sea encircling the group was constantly agitated, and vast quantities of pumice stone were being thrown to the surface. At the Island of Vaitupu it lay two feet thick upon the reef. When first upheaved it was hot, and occasionally mixed with lava. This phenomenon was believed to be the advance guard of a mighty eruption, and the natives were looking for such an occurrence daily. The group is of volcanic origin.

Reports of a remarkable convulsion of nature came from Tanna Island, and were vouched for by Captain Kilgour, master of the schooner Stanley. The phenomenon occurred on the 10th of January last. At that date a very severe shock of earthquake was experienced, and immediately afterward a body of land, estimated at 40 acres, situated at the north entrance of the harbor, slid into the sea, and was absorbed out of sight, as if it were a pebble.

A New Zealand captain who reached Apia a few days before, brought the intelligence that a disastrous volcano eruption occurred at Blanche Bay, New Britain, in the early part of last February. An old crater that had been inactive during many years broke out with awful and alarming fury, destroying two villages, the natives of which fortunately escaped with their lives. The eruption was preceded by frequent shocks of earthquake, which alarmed the inhabitants, and taking a warning therefrom they fled just in time to save themselves. The shocks were very severe in New Britain, but were not felt on the Duke of York Island, only 20 miles distant. After the eruption it was discovered that great quantities of pumice stone had been thrown up from the sea, the extent being several miles in length and averaging half a mile in breadth. The pumice was spread in a crust of from three to five feet in depth. The old crater is still active and throwing up immense clouds of thick black smoke, accompanied by red hot stones and ashes. A loud roaring is distinctly audible for a distance of 20 miles from the crater. On the 3d of February a terrific shock rent portions of the coast of New Britain, and on the 4th two tidal waves swept with irresistible power along the shore, carrying with them fabulous bodies of earth. The whole face of nature has been changed by these convulsions.

The British war vessel Sapphire, says the *San Francisco Chronicle*, touched at the island of Tongatabu, one of the Tonga group, in April, and leaving there on the 15th of the month steamed for the island of Vavau, a volcanic island which first made its appearance above the water in 1854 and has been constantly growing ever since, but as imperceptibly as a human being grows. The object of the officers of the warship was to note the changes of this growth in the years past. The captain of the ship John Wesley touched at the island in 1862, when it had reached a height of about 12 feet above the level of the sea. A few years later a Dutch captain estimated its elevation at 30 feet, and now it has attained an elevation of 111 feet as correctly measured by the Sapphire. Its summit was covered with sulphur, and large jets of steam and smoke issue slowly from the countless crevices. Except that no volcano is in sight, the ground is precisely like that adjacent to the great crater of Kilauea, on the Sandwich Islands, from which myriads of jets of steam are constantly ejected.

On the 11th of May, 1877, the waters of Apia harbor rose and fell with surprising rapidity. After a little while we had news of earthquakes and tidal waves on the American continent on May 10 of the same year. These waves must have traveled at a tremendous rate of speed. Since the 11th of May last the tides of Apia harbor have been remarkably low. Opposite Matafele the bank, or shoal, has grown considerably; in fact, all round the beach the land seems to have risen.

How to Kill a Tapeworm in an Hour.

Dr. Karl Bettelheim, of Vienna, narrates, in the *Deutsches Archiv*, a heroic method and nearly sure cure in the short space of time of three quarters of an hour to two hours. It is this: He inserts a tube in the œsophagus, to the stomach, and pours down from 200 to 400 grammes of a very concentrated decoction of pomegranate root, having previously had his patient fast for 24 hours. The worm is stupefied, and passed, head and all, to a certainty; the patient has no sickness of the stomach, and no naseous swallowing to do; and the drug is cheap.—*Med. and Surg. Reporter.*

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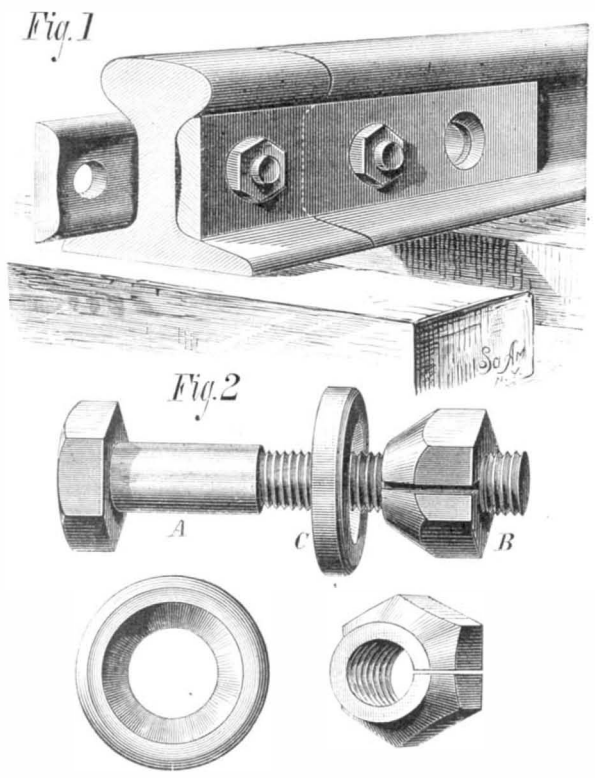
A NEW NUT LOCK.

A novel nut lock is shown in the accompanying engraving, Fig. 1 representing the device as applied to the fish plates of railway rails, and Fig. 2 shows the bolt, nut, and washer in detail.

While this improved nut lock is designed more especially for the purpose indicated, it may be used wherever a secure bolt is required.

The threaded portion of the bolt, A, decreases gradually and slightly in diameter from the outer end inward toward the head, and the nut, B, which is split lengthwise on one side, is made conical, and is fitted to a countersunk washer, C, or to countersunk holes in the fish plates, as represented in Fig. 1. The nut, when screwed down on the washer or fish plate, is contracted by the engagement of the two conical surfaces, and is thus made to bind the bolt so that it cannot become loosened accidentally by jarring or concussion. The conical nut and countersunk washer may be used advantageously in connection with ordinary bolts.



WHITMARSH'S NUT LOCK.

This improvement was recently patented by Mr. John W. Whitmarsh, of Galesburg, Ill., from whom further information may be obtained.

SIMPLE TELEPHONES.

The telephone, although now generally well known, is no less interesting than it was at first. There are many forms of this wonderful instrument, some of which are very simple, easily constructed, and easily operated, while others are more complicated. The principle is the same in all.

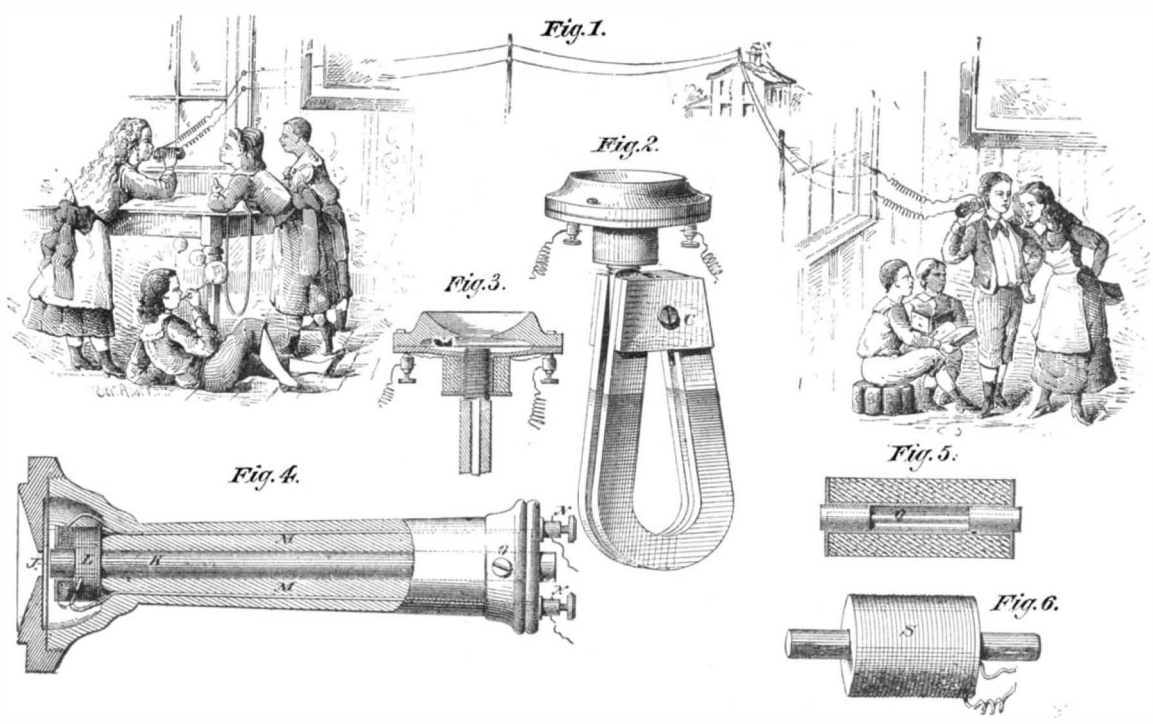
In the accompanying engraving, Fig. 1 represents a telephone doing service; Fig. 2 is an easily constructed instrument; Fig. 3 is a vertical section of a portion of the same; Fig. 4 is a telephone of the Bell form; and Figs. 5 and 6 illustrate methods of magnetizing bars for telephones.

The telephone shown in Fig. 2 employs two ordinary U-magnets, which may be of any convenient size, and may be bought at almost any hardware store or toy shop. A soft iron core is clamped between two similar poles of the magnets, and is threaded to receive the spool, which has formed on it a flange for supporting the diaphragm and mouthpiece. The ends of the wire which forms the coil are connected with the binding posts screwed into the flange. The disk or diaphragm consists of ordinary ferrotype plate, such as may be purchased from any photographer.

The telephone shown in Fig. 4 has a wooden handle, which contains a round bar magnet, K, having on one end a coil, L, of fine insulated wire. The terminals of the coil are connected with the binding posts, N, at the end of the handle. The iron disk, J, is supported in the mouthpiece near the end of the magnet.

When sound waves strike the disk of the transmitting telephone, the disk vibrates in front of the magnet, and as it is itself a magnet by induction its power is constantly changing as it vibrates. As the plate moves toward the coil a current is induced in the latter, which traverses the whole length of the wire connecting it with a distant instrument; as the plate returns, a reverse current follows. These undulating currents produce in the disk of the receiving instrument vibrations which are similar to those in the transmitting instrument.

For the benefit of any who may desire to construct a telephone, we have published in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 142, complete directions, with full sized drawings, for making a working telephone.



SIMPLE TELEPHONES.

British Mining and Metallurgical Interests.

It is an accepted and indisputable fact that the mining and metallurgical interests of Great Britain are in all respects ahead of those of all the world beside, but it is doubtful whether even we ourselves properly grasp the enormous magnitude of the industries placed under those heads. The statistical features of our mines and metal manufactures, as given in the preface to Messrs. Kelly's new "Engineering Directory," however, strike one with peculiar force, and give us an impressive idea of their power and importance. From this source we gather that the total number of collieries, mines, and pits classed under carboniferous and metalliferous mines amount to over 5,000; in which total, however, is included a number of fireclay, limestone, purbeck, and various other workings, which, perhaps, hardly come under the category of mines. The principal mines are: Coal, 3,722; iron and ironstone, 600; lead, 390; copper, 80; tin, 103; zinc, 11; iron pyrites, 36; barytes, 25. The number of persons, male and female, employed as miners above and below ground, according to the returns issued for the year 1877, was 494,391. Of these 57,395 were employed in and about the metalliferous mines, the remainder thus: Coal miners, 268,091; copper miners, 3,063; tin miners, 10,617; lead miners, 14,563; iron miners, 20,930; undefined, 38,712. Outside the ranks of the miners proper are the following: Workers and dealers in coal, 68,860; ditto in copper, 5,758; ditto in tin and quicksilver, 26,199; ditto in zinc, 1,723; ditto in lead and antimony, 3,729; ditto in brass and other mixed metals, 54,366; and ditto in iron and steel, 360,356. Taken from another and slightly varied point of view, the statistics as to the number of persons employed in each particular branch of the leading metallic manufactures read thus: Iron and steel, 341,965; copper, 3,289; coppersmiths, 2,295: brass manufacturers, braziers, etc., 20,983; locksmiths, bell-hangers, etc., 7,154; gas-fitters, 8,615; wire workers, 7,435. These are still further particularized in the "occupations of the people" as under: Engine and machine makers, 106,437; spinning, weaving ditto, 9,668; agricultural implement ditto, 3,617; millwrights, 7,538; tool makers and dealers, 7,453; file ditto (including females), 9,001; saw ditto, 1,930; cutlers, 17,066; whitesmiths, 8,588; blacksmiths, 112,035; nail manufacturers (including females), 23,231; anchor smiths, 4,163.—*Ironmonger.*

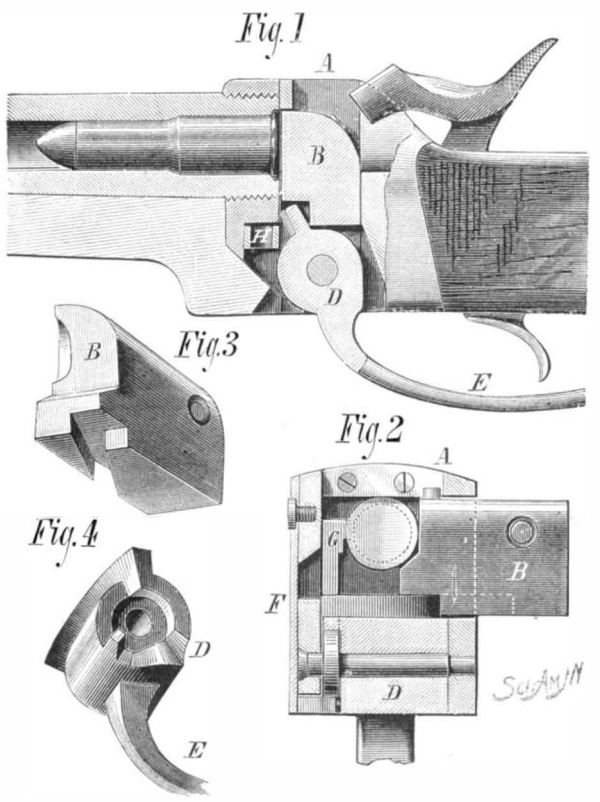
Coal Gas does not Injure Book Bindings.

In a recent letter published in the *Library Journal*, Professor Wolcott Gibbs, of Harvard University, says:

"You will remember that some time since I made an examination of the binding of books in the Public Library, supposed to be injured by the products of the combustion of coal gas. I arrived at the conclusion that there was no sufficient evidence to show that such was the case. I have since made a careful examination of books in the Athenæum, College, and Astor Libraries, and have found precisely the same state of things. You are aware that gas has never been used in the College and Astor Libraries at all, and that in that of the Boston Athenæum gas is largely used in the reading-room, but not in the library proper. I found in each a large number of old books bound in calf, which presented the same appearance as those which I saw at the Public Library. These were all old books and all bound in calf. Mr. Wilson, binder to Little & Brown, and a man of large experience, told me that he was satisfied that the trouble was in the tanning of the leather and not in the action of gas, the older kinds of leather used by binders being of poor quality and badly tanned. I analyzed a number of samples of the leather in my own laboratory, and find no free acid whatever. On the whole, therefore, I see no reason to change my opinion in the matter."

NEW BREECH-LOADING RIFLE.

The manufacture of firearms has reached such a state of perfection in this country that nearly all the world looks to us for rifles. American inventors, by their activity in this direction, indicate a determination to maintain supremacy both as to quality and quantity of production. Our engraving represents one of the most recent improvements in breech-loading firearms, the invention of Mr. James McAlpine, of 316 Chapel street, New Haven, Conn.



McALPINE'S BREECH-LOADING RIFLE.

The invention consists mainly in a novel device for operating the laterally-moving breech block and for working the shell ejector.

In the engraving, Fig. 1 is a side view, partly in section. Fig. 2 is a transverse section, taken through the breech at the rear of the breech block.

Fig. 3 is a detail perspective view of the breech, and Fig. 4 is a detail view of the actuating cam. In the breech, A, there is a mortise for receiving the breech block, B, which carries a percussion pin that is in position to be struck by the hammer when the cartridge is to be exploded. Below the breech block there is an actuating cam, D, which is nearly cylindrical in form, having a flange on its periphery which is disposed spirally. This flange engages a groove in the breech block, so that when the actuating cam is turned on its pivot by means of the handle, E, projecting from one of its sides, the breech block will be moved laterally so as to expose the bore of the rifle. A detent spring, F, is secured to one side of the breech, and carries a pin which rests in one of two concavities in the end of the actuating cam, and thus holds the operating lever in either of its positions. Upon the pivot with the actuating cam there is a cartridge-ejecting lever, G, which receives its outward impulse by engagement with a shoulder on the actuating cam. It is afterward moved by the spring, H, so as to completely eject the shell.

The breech is opened by the revolution of the actuating cam, a cartridge is inserted in the barrel, the breech is closed by the upward movement of the handle, E, and the cartridge is exploded in the usual way. The breech is opened by a downward movement of the handle, which also ejects the shell. The advantages claimed for the improvement are: That the movements of the acting parts are positive. The parts are simple, strong, and few in number, so that the construction is not complicated or expensive. The breech is tightly and securely closed when the parts are in firing position, and yet is readily opened for ejecting the car-

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tridge shell and inserting a fresh cartridge. For further information address the inventor as above.

THE BEARDED SAKI.

In the popular Monkey House, on the side where the lemurs are to be found, is a very pretty little black monkey, which is shown in our illustration. It is the black or bearded saki, *Pithecia satanus*, a native of the Lower Amazons in South America. The one represented by our artist, which is a female, was purchased by the London Zoölogical Society recently. It shares the cage of a Barbary ape, and they play together in the friendliest and funniest manner. A golden-headed marmoset has just been added to the collection of the society, which is now rich in small animals, as well as in antelopes, in elephants, and in birds.

We take our engraving from the *Illustrated London News*.

Boracic Acid in Treatment of Cholera.

Surgeon W. J. Butler, of the Madras Medical Service, calls the attention of the medical profession, through the *Lancet*, to the value of boracic acid in the treatment of cholera. He states that having had considerable experience in the treatment of this fatal malady in the course of numerous and extensive epidemics in Burmah and Southern India, and having employed all the various treatments which have had any claim to success, with very poor results, he was induced to consider whether any more efficacious remedy could not be resorted to. At the period when the properties of boracic acid were made public he determined to try its effects.

The pure acid not being procurable, the biborate of soda (borax) was at first used, and with marked benefit, the percentage of recoveries being from 70 to 75 per cent. Subsequently he has used the pure acid in ten grain doses every two hours, combined with borax or bicarbonate of soda, under which treatment every case has recovered. He adds that in no case were any signs of irritation or ill effects observed from the remedy; and that in all of them the renal secretion was reestablished with much greater facility than under any other method of treatment.

Cement for Sealing Bottles, etc.

Mix three parts of resin, one of caustic soda, and five of water; this composition is then mixed with half its weight of plaster of Paris. The compound sets in three quarters of an hour, adheres strongly, is not permeable like plaster used alone, and is attacked only slightly by warm water.

RED BIRD OF PARADISE.

This is a most beautiful bird, and both for the soft, delicate purity of the tints with which it is adorned, and the harmony of their arrangement, may challenge competition with any of the feathered race. In size it is almost equal to a small pigeon. The forehead and chin are clothed with soft velvet-like feathers of the intensest green, so arranged as to form a sort of double crest on the forehead, and a sharply defined gorget on the throat. The head, back, and shoulders, together with a band around the neck immediately below the green gorget, are rich orange-yellow, golden in the center, and tinged with carmine on the margins. The wings, chest, and abdomen are a deep warm chocolate-brown, and the tail is somewhat of the same tint, but not quite so dark. Over the tail falls a long double tuft of loose plumy feathers of a beautiful carmine, and two long black filamentous appendages also hang from the tail and extend to a considerable length.

We take our engraving from Wood's "Natural History."

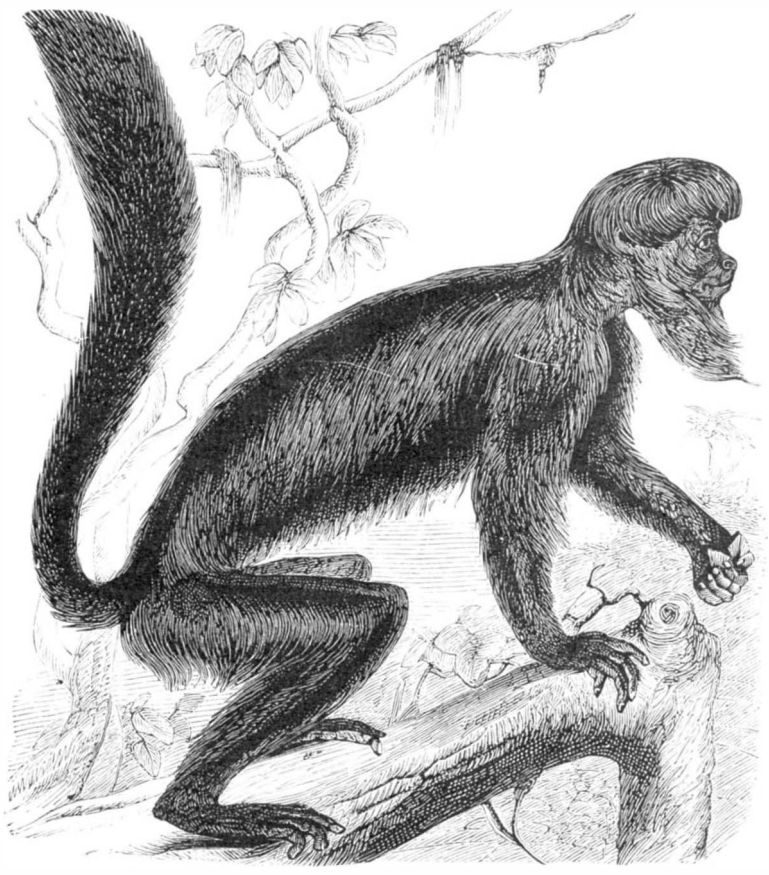
A Transplanted Scalp.

Four years ago Miss Lucy A. Osborne, of New Milford, Conn., had her scalp, right ear, and part of the right cheek torn off by the catching of her hair in rapidly moving machinery. She has since been under treatment in a hospital in this city, but was recently sent home with a new scalp, produced by the process of skin grafting, the grafts being furnished by the hospital surgeons. It is said that 12,000 pieces were used in the operation. One of the surgeons contributed from his person 1,202 pieces, and another gave 865. The appearance of the scalp now is similar to that of a healed wound. Of course, there can be no growth of hair thereon. The eyes still present a slightly drawn appearance. The wounds of the cheek and ear have been neatly dressed, the former leaving scarcely a scar. In the first of the grafting process, bits of skin the size of nickel pieces were employed, but not with good success, and at the suggestion of an English surgeon much smaller pieces were substituted, and with excellent results. Miss Osborne is now 22 years old.

Manufacture of White Lead.

A new process for the manufacture of white lead has, according to one of our London exchanges, been designed by Mr. Maxwell Lyte. Instead of using sheet lead, as is the common practice, he dissolves sulphate or chloride of lead in acidulated brine or in hydrochloric acid, and precipitates with zinc, spongy metallic lead resulting. The nitrates, acetates, etc., may be similarly treated. One part of zinc precipitates about three of lead, and it may be recovered by precipitation as an oxide, fit for distillation and conversion into metallic zinc again.

The spongy lead furnished by this process is much more easily acted upon more easily carbonated than lead in the ordinary condition. It can be manufactured upon a most extensive scale, and it is less costly, more durable, and of better color than any other white paint known.



BEARDED SAKI AT THE ZOOLOGICAL GARDENS, LONDON.

RED BIRD OF PARADISE.

THE TORREY BOTANICAL CLUB.

At the regular monthly meeting of the Torrey Botanical Club, held in the Herbarium Room of Columbia College on the evening of Tuesday, September 10, Mr. O. R. Willis read some notes in regard to the

FLORA OF NEW JERSEY.

The author stated that he had recently received specimens, from Dr. Hexamer, of New Castle, of the common heather (*Calluna vulgaris*), which was found growing sparingly near Egg Harbor. This plant has been found hitherto in a wild state, rather locally, in Nova Scotia, Cape Breton, Newfoundland, Maine, and Massachusetts, but never so far south as New Jersey. That it should grow in a wild state in New Jersey at all is quite remarkable; but that it should be found in its very southern extremity is still more wonderful. Mr. Willis had also received a communication from Dr. Porter, of Lafayette College, informing him that he (Dr. Porter), in company with Dr. Green, had made a botanical excursion, in August, to Swart's Wood Lake, about six miles north of Newton, in Sussex county, N. J. In this little lake, three miles long by one mile wide, these two botanists found numerous specimens of the yellow nelumbo (*Nelumbo luteum*), a plant which neither of them had ever seen before in a living state. Dr. Porter said that some of the leaves were spread out and seemed to float upon the surface of the water, while others were elevated from one to two feet above it. The flowering season was over; the flower stalks, however, which were still standing, rose, like some of the leaves, two feet above the water. These gentlemen also found, on the same excursion, *Nasturtium lacustre*, seen for the first time so far east and south; and *Bidens Beckii*, not before reported from New Jersey. Mr. Willis stated that he himself had collected the *Drosera rotundifolia*, at Lyonsdale, N. Y., at the falls of the Moose River, growing in the crevices of the rocks.

Prof. J. D. Hyatt asked how far north *Vincetoxicum scoparium* had been found. It is mentioned in the Manuals from Florida. Prof. Hyatt reported a specimen from Bluffton, S. C.

Prof. A. Wood read some notes on the Western plants to which he had called the attention of the Club at the June meeting. He stated that his diamond willow (*Salix adamas*) was, in all probability, a good species. This was formerly included under *S. cordata* as a variety. He read a description of the plant, and exhibited cross sections of the branches and pieces of the bark, the latter being very remarkable for the large, deep, diamond, or lozenge-shaped depressions found in it. These depressions are scars left by the falling of the branches, and which are subsequently covered with a cortical layer. The proposed name (*S. adamas*) for this species is in allusion to the shape of these scars. He stated that *Actinella discoidea* (Wood) proves to be a good species; *Aster ciliosus* (Wood) proves to be the same as *Diplopappus ericoides*, but as the latter genus is now merged into *Aster*, and there is already a species *ericoides* of the latter, *A. ciliosus* (Wood) should consequently hold good; *Erigeron subscaposum* (Wood) has already been described by Buckley as *E. nudicaulis; E. pinnatifidum* (Wood) proves to be the same as *Machæranthera tanacetifolia;* what was supposed to be *Spiranthes romanzoviana* turns out to be a new species, to be called *S. robusta* (Wood).

Mr. Charlton, of New Brighton, made some remarks on a *Eucalyptus globulus*, which he had succeeded in raising this year from seed furnished last fall by Dr. Kunze. He stated that the tree was now 12 feet high, with foliage 25 feet in circumference at the base, and was the most remarkable instance of rapid growth in a plant that he had ever known, and plant raising had been the business of his entire life. He said that the tree emitted a most delightful balsamic fragrance during a warm summer evening, and that at such a time it was a genuine pleasure to stand near and enjoy the delicious odor. He regretted that the tree would not stand our climate during the winter, that he might make further observations on it; and he was certain that no greenhouse could long accommodate it, on account of the rapidity of its growth.

Mr. Brown exhibited specimens of *Primula angustifolia* brought from the summit of Pike's Peak.

Prof. D. S. Martin exhibited a specimen of decaying ash, the woody matter of which was of a beautiful shade of verdigris green, due to the mycelium of a fungus (*Peziza æruginosa*), the fruit of which appeared on the surface of the wood under the form of bluish-green cups. One of the members stated that

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wood tinged in this manner by the same fungus is used in England for the manufacture of fancy articles known as "Tunbridge ware."

Mr. W. H. Leggett called attention to the fact that a species of *Galium* has been found to leave a stain on the fingers, and asked the probable cause. He stated as the result of his recent studies of the genus *Lechea*, that *L. Novæ-Cæsareæ* of Austin is *L. thymifolia* of Michaux; and that Pursh's *L. thymifolia*, mentioned in the botanies, will have to be renamed.

How a Spider Captured a Potato Beetle.

I wish to place on record with you an incident which came under my observation, and which almost equals the account of a spider raising a snake in its web, which you published some time ago. I was sitting on my back porch one day this summer, when I observed a potato bug slowly approaching along the floor. Anxious to annihilate as many as possible of these pests, I kept my eye on him until he should come in reach, when I could put my foot on him. While watching in this way I noticed a pretty good sized spider approaching the bug. At a little distance he stopped to survey his contemplated victim, and then, with a mind seemingly determined as to what course to pursue, ran around on the opposite side of the bug, and with an apparent "nip" at him turned the bug from his course, and toward a corner where I noticed the spider had a web some four or more inches from the floor. The bug had no inclination to go in that direction, but he was closely driven by the spider, which ran first to one side and then the other, exactly like a shepherd dog driving a sheep, hurrying his victim up with an occasional "nip" or bite at his side. All this was something new to me in the habits and ways of the spider, and I watched with intense interest to see what the result would be.

When the bug had been driven into the corner at a point directly under the web, the spider changed tactics, and made a series of circles rapidly around the bug, first in one direction and then in another, occasionally taking a run up into the web. While I was unable to see the delicate thread spun by the spider, I saw that the bug's legs soon became so entangled that he could not make any headway, but could only struggle around in a limited latitude, and which became more and more limited as the spider untiringly continued his work. Being compelled to leave at this moment, I returned again in about half an hour. I then found the bug turned on his back and his feet apparently quite firmly bound. He was quite motionless, and I thought was dead, but he soon showed signs of life by vigorous kicking, which nearly released him.

The spider had been running up and down at different points, but quickly left that work, and sliding down to the bug seemed to attack his throat, and in such a manner that the bug gave a few spasmodic kicks and seemed to give up the ghost. The spider then returned to his work of attaching lines to the bug and the web. They were soon so numerous that I could see them, besides the light had become more favorable. The regularity of the lines formed a sort of funnel, diverging as they did from the bug to the outer parts of the web above.

After a time the spider seemed to have lines enough attached, and began the new work of shortening each line, as it appeared. He passed from line to line many times over, stopping an instant at each. I was again called away at this juncture, and did not see the curiosity again until the next day. The bug was then elevated over an inch above the floor, and the third day he was safely lodged in the center of the web, some 5 inches from the floor, and all the tackle employed in hoisting completely cleared away. In the web were the carcasses of two other potato bugs, which I have no doubt were caught in like manner, though they may have crawled up the wall into the web. I cannot name the variety of spider, but it is a very common one, rather good size, taken altogether, but small as compared with the bug. The spider could not have weighed one eighth as much as the bug; his body was long and slender, with long slender legs, a very ordinary species of house spider (of brown color) and called a large spider on account of their long legs

This may be a very common habit of the spider, running out and driving in game to a place where it can be secured and hoisted, but I never heard of the like before.

R. B. TULLER.

Wax-Producing Plants.

In a memoir on the cow tree, which we have before referred to as having been recently presented to the French Academy by M. Boussingault, the author recommends the cultivation of this tree for the sake of its wax, which he believes may form a valuable substitute for beeswax for various industrial purposes.

Bees, in preparing wax, merely gather it from plants the majority of which secrete this substance, some of them in such large quantities as to form important objects of commerce. Certain palm trees, some plants belonging to the families of *Myricaceæ*, *Artocarps*, *Terebinths*, and even some *Cucurbits*, are worked for the sake of the wax which can be gathered from them. Undoubtedly the product thus obtained is not as pure as beeswax, but then it is cheaper; and so, if it were for no other purpose, it would still be gathered for adulterating the latter. "Humboldt's palm wax," *Cera de palma*, is at once the commonest and best of the vegetable waxes. It exudes naturally from the bark of a New Granada palm (*Ceroxylon audicola*). The average yield is 25 lbs. to a tree. It forms a considerable article of commerce among the natives. There is also a palm (*Copernicia cerifera*) which yields the "Carnauba wax." The tree, 30 to 40 feet high, is a native of Brazil. The wax is found as a coating on the foliage, and is obtained by shaking the detached leaves so as to loosen the wax. Each leaf furnishes about fifty grains of a scaly whitish powder, which is melted in pots and then run into cakes. It is used to adulterate beeswax. A number of the plants of the genus *Myrica* yield a wax known as "Candleberry or myrtle wax." These plants are mostly shrubs with fragrant foliage, scattered over the temperate regions of both hemispheres. The fruits are nuts or drupes, covered with a coating of a waxy, resinous secretion, which is separated from the berries by boiling them in water and then straining the wax, which appears on the surface, through coarse cloth. Of the North American species, *Myrica cerifera* and *M. Carolinensis*, the latter is said to be the more valuable, giving wax of a greenish-yellow color, of a finer consistence than the beeswax, and yielding at the rate of one pound of wax to four pounds of berries. Candles manufactured from it diffuse a delightful odor when burning. There are several species of *Myrica* indigenous to Southern Africa, the wax from which is an article of commerce. *Myrica faga*, a native of the Azores, furnishes a wax frequently used in candle-making. Other species, such as *M. sapida*, of China, *M. cordifolia*, and *M. quercifolia*, of the Cape of Good Hope, also yield valuable wax.

A hard white wax, now a considerable article of export from Japan, under the name of "Japan wax," is the product of the fruit *Rhus succedanea*, a small tree cultivated in Japan for this purpose. It is exported in square blocks, averaging 130 lbs. each. Candles are commonly made from it by the Japanese. "Peetha wax" is a secretion resembling the bloom on plums, etc., found on the surface of the fruit of the white gourd of India (*Benincasa cerifera*), of the family of *Cucurbits*. It is stated that the dwarf birch (*Betula nana*) yields a wax similar to that afforded by the *Myrica* and is used for like purposes. The vegetable wax of Sumatra, or wax of Geta- (or Gutta-) Lahoë, is the product of a species of fig (*Ficus cerifera*), and is used for making candles. The wax tree of the Cordilleras (*Elægia utilis*) is remarkable for the quantity of green resinous or waxy matter secreted by the stipules which invest the unexpanded buds. The wax is collected by the Indians and used to varnish useful and ornamental objects. It would require a volume to pass in review all the plants which afford wax, but those that we have just mentioned embrace those that are best known and most utilized as producers of this valuable article.

Safety in Mines.

A Prussian mining engineer of twenty years' practical employment in coal mines, claims to have discovered a means by which, in every degree of development of fire damp, an explosion can be prevented, and offers it to any state, or to the owners of coal mines in any state, on consideration that a honorarium shall be guaranteed in proportion to the importance of the invention, such remuneration not to be paid until the practical value of the invention is demonstrated.

The inventions of Davy, Stephenson, and others—the safety lamp—render it possible, under necessary precautions, to enter underground places filled with explosive fire damp, yet the accidents caused by fire damp explosions are even now so frequent as to prove that descending into coal mines wherein fire damp is generated is still connected with great peril.

The value of any invention by which this danger can be completely avoided can hardly be estimated.

The Teeth of the Mound Builders.

Dr. T. S. Sozinskey, having, a few weeks ago, taken part, with the members of the Kansas City Academy of Sciences, in opening four pits of the mound builders in Clay county, Mo., was led to make an examination of the teeth in the skulls found on the occasion. In his article on this subject in the *Dental Cosmos*, he states that in every jaw that he examined the teeth were placed regularly, except in two instances, where the molars were slightly out of line, and that they were very close together—in contact all around, as a rule. Every jaw, with one exception, contained sixteen well developed teeth. The exception was an odd lower jaw, apparently that of an adult, which had but fourteen teeth, there being two molars on either side. The canines were not particularly noticeable in any; but in all the incisors were large and almost circular in form, a very noteworthy fact. The crowns of all the teeth were worn more or less flat, and to such an extent in many cases that they were nearly on a line with the gums. This gave the front teeth a very peculiar appearance. Not one tooth examined was either broken or affected by disease.

Dr. Sozinskey concludes that the mound builders lived on food (probably mostly uncooked) which required a great deal of chewing. They rarely tried their teeth on nuts or uncooked grains, else we should have found them more or less chipped, which was not the case. It would seem, from their incisors being ground down flat on the crowns, that they were not in the habit of dividing their food into mouthfuls by their teeth; but that, on the contrary, it was divided by some mechanical method. The front teeth, however, which are kept sharp by biting the food off into pieces, may, of necessity, have become ground down when the molars and bicuspids were ground off to a certain extent. It may be, however, that these people gave their lower jaw a peculiar twist in eating, unknown to us, which might account for the truncated condition of their front teeth. As the enamel of the crowns of the teeth of the mound builders was absent for a great part of their lives, and yet the teeth remained sound, it follows (contrary to the popular belief) that when a portion of the enamel is removed, the decay of the rest of the tooth does not necessarily follow. The result of this examination, showing the soundness of the teeth of this prehistoric race, and the consequent absence of toothaches and dentists, affords another proof of the statement made by Dr. Sozinskey elsewhere, that "from the wildest savages, in whom they are sound and regular, the teeth progressively deteriorate, and are at their worst in people in the foremost grade of civilization."

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, October 12, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Venus rises	5 02 mo.	Uranus rises	2 17 mo.
Mars rises	5 31 mo.	Neptune rises	6 17 eve.
Jupiter sets	11 17 eve.	Neptune in meridian	1 06 mo.
Saturn in meridian	10 30 eve.		

FIRST MAGNITUDE STARS, ETC.

	H.M.		H.M.
Alpheratz in meridian	10 36 eve.	Procyon rises	11 47 eve.
Mira (var.) rises	6 59 eve.	Regulus rises	1 55 mo.
Algol (var.) in meridian	1 37 mo.	Spica	invisible.
7 stars (Pleiades) rise	6 46 eve.	Arcturus sets	7 56 eve.
Aldebaran rises	8 05 eve.	Antares sets	7 16 eve.
Capella rises	5 32 eve.	Vega in meridian	5 07 eve.
Rigel rises	10 11 eve.	Altair in meridian	6 19 eve.
Betelgeuse rises	9 57 eve.	Deneb in meridian	7 12 eve.
Sirius rises	0 16 mo.	Fomalhaut in meridian	9 25 eve.

REMARKS.

Mercury and Mars are in conjunction, Mercury being the most northern. Venus and Mars will be in conjunction October 21, 4h. 21m. morning—1h. 2m. before rising—and as Venus has the greater apparent eastward motion, she will be a trifle (5·48 sec.) east of Mars at rising.

Mira Ceti (*Omicron Ceti*, right ascension 11h. 48m., dec. 3° 32′—) is now at greatest brilliancy, remaining so until October 18. This variable rises at a favorable hour for observation and about 5° south of the east point. Ten degrees south of *Mira* are four small stars, nearly forming a square, each side being about 3°; and 10° southwest of *Mira* is a 3d magnitude star, which, with the most eastern star in the square, and *Mira*, forms an equilateral triangle; with the northwestern star of the square, forms an isosceles triangle.

New Agricultural Inventions.

Mr. Albert J. Alley, of Fond du Lac, Wis., has patented an improved Stump Machine, Grubber, or Capstan Power for pulling stumps and grubs, for moving buildings, and for other similar uses. It is simple and effective.

Mr. Fredric W. Degen, of New Athens, Ill., has patented an improved Sulky Cultivator which is simple, easily guided and controlled, of light draught, and readily adjusted to work closer to or further from the plants, as may be required.

Mr. Charles Friedeborn, of Clare, Mich., has patented an improved Churn Dasher, which consists in an obtusely conical plate of tinned iron, having an axial tube or socket for attaching the handle, and an inverted central inner cone for scattering the cream, and covered at intervals with radial semicircular tubes, which are tapering toward the central socket, and provided with side apertures, the cone being perforated underneath and between the tubes.

Mr. Archibald T. Clark, of Manchester, N. C., has patented an improvement in Farmers' Tools and Handles. The object of this invention is to furnish to farmers, or others that use tools for working in the soil, sets of tools, such as hoes, rakes, brier hooks, pitchforks, etc., with a handle adapted for application to any one tool of the set, and which may be readily removed from one tool and applied to another, thereby saving the expense of a separate handle for each tool.

An improved Sulky Plow has been patented by Mr. Dennis W. Palmer, of Detroit, Me. The object of this invention is to furnish an improved device for suspending and managing a sulky plow so that a farmer can attach and use any plow of his choice, and hitch the team to the beam of the same in the usual way as if the plow were not attached to a vehicle, and can raise and lower the plow out of and into the ground and give it any pitch desired.

Mr. George L. Rider, of Kent, Iowa, has devised an improved Check Row Attachment for any ordinary corn planter. It is so constructed as to be practically unaffected by changes of the weather; it is simple, strong, and inexpensive in manufacture.

Solidification of Petroleum.

A very curious effect is produced on the oils of petroleum, even those of the least gravity, by the addition of powdered soapwort (*Saponaria*), a herbaceous plant of the order Caryophyllaceæ. On digesting the powder with water and mixing it with the oil, the latter forms a very thick mucilage, so that the vessel in which the experiment is made can be turned upside down without spilling the contents. What is still more singular is that if a few drops of carbolic acid be added, and the mucilage shaken, it becomes in a few minutes perfectly limpid again.—*Les Mondes.*

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NEW STETHOSCOPIC MICROPHONE.

By means of this apparatus of MM. Ducretet & Co., of Paris, the feeblest pulsations of the heart, pulse, and arteries may be heard in several telephones placed in circuit. It is a very delicate instrument, and exquisitely sensitive, and this is its fault, if it have any.

Two tambours, such as devised by M. Mavey, are coupled to a microphone; one of these, T′, serves as a searcher; the other, T, as receiver. The feeblest movements communicated to the tambour, T′, act, through the medium of the India-rubber tube which unites them, upon the tambour, T, and, consequently, on the lever microphone, L, the sensitiveness of which can be regulated by the counterpoise, P O. The microphone terminates in a pencil, C, formed of retort carbon or of plumbago, which rests on a disk of the same material fixed on the receiving tambour. The whole forms a complete circuit, in which is a Daniell or Léclanché battery of one to three elements, and the telephones through which are heard the pulsations from the searching tambour, T′.

This microphone is susceptible of modification, and will undoubtedly be the means of more extended physiological observations. By substituting a small funnel for the tambour, T, speech may be transmitted.

Tubular Water and Air Bed.

Mr. J. Millar, L.R.C.P.Ed., the physician of Bethnal House Asylum, Eng., has designed a bed capable of being distended with air or water, or both. It is made in compartments formed by rolls, or bolsters, some three feet in length, lying across the bedstead, and retained in position side to side by a case. The great advantages of this construction are obvious. The bed is capable of being adapted to any pressure by filling each separate tube or bolster to the required degree. Thus the pressure may be taken off a tender part by simply drawing off a little water or allowing some of the air to escape. The tubes, which lie in the center of the bed, and are liable to be soiled, can be withdrawn and changed at pleasure, or, for the convenient use of the bed pan, one or more may be depressed. If the bed is wetted, the fluid gravitates into the interspaces of the bolsters, and the patient is saved from lying in a pool. One or more of the tubes may be kept filled with warm water in special cases with great facility.

A PLATFORM SCALE OF CONSTANT EQUILIBRIUM.

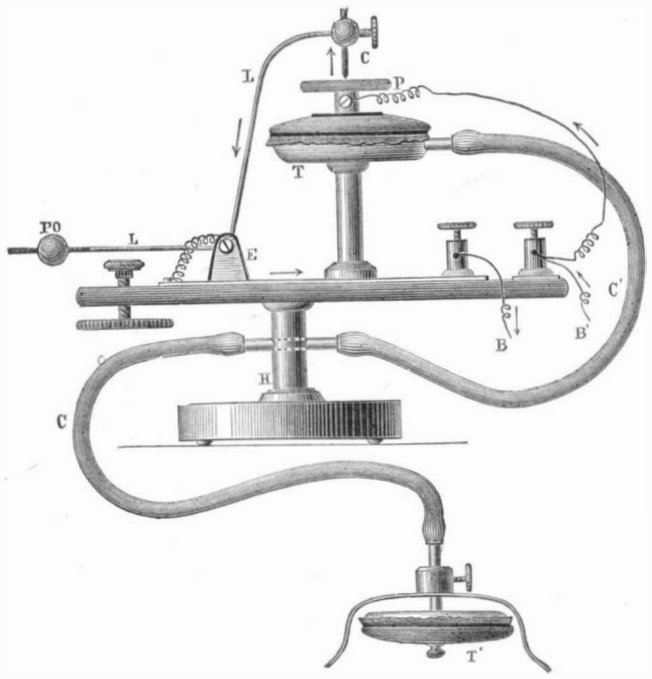
M. A. Redier, of Paris, constructed lately a new recording balance, which is intended to furnish to physicians, physiologists, agricultural chemists, etc., great experimental facilities in their investigations. It is a platform scale in constant equilibrium; it registers continuously the variations in weight of any object placed upon it—animated, such as an animal, a plant, etc., or inanimated, such as a volatile substance, a lamp in combustion, or any object of variable weight. The scale traces curved lines representing the gain and the loss of weight of the objects under investigation, and this with a remarkable sensitiveness and exactitude.

This scale, when charged with a weight of 620 lbs., will record grains. A body much less heavy, such as a lighted wax candle, will equally as well record all changes in weight by the curves on the paper. This sensitiveness is attained by a constant state of oscillation, which animates the balance and displaces it by very small quantities. Few persons know this property of balances. Messrs. Hervé Mangon and Melsens, of Brussels, seem to be the first who have brought this property to light and applied it practically.

Our engraving represents this ingenious apparatus. On a stand next to the platform are placed the registering cylinder, P, the clockwork, H, which rotates slowly, and the double wheel work, which determines the state of constant equilibrium.

The principle by which the equilibrium is restored, as soon as it has been disturbed by some cause or other, is this: If we place on an ordinary balance a glass full of water, counterbalanced by a weight, and if we dip into that glass a mass, whatever it may be, hanging from a thread, the equilibrium will be destroyed; in proportion as the plunger penetrates more or less into the liquid, it will more or less disturb the equilibrium. It is such a plunger which M. Hervé Mangon has made use of to establish the state of constant equilibrium on the platform scale in question.

Under the little platform of the instrument is a cylindrical vase, V, three fourths filled with water; a cylindrical plunger, of which the supporting thread is rolled over the pulley, R, is lowered or hoisted by the wheels of the pulley as soon as the large platform experiences any augmentation or diminution of weight. The equilibrium restores itself immediately, and the motions of the pulley, R, are transmitted to the lead pencil which passes over the surface of the registering cylinder, P, leaving on the unrolled paper traces of all its movements. The wheels of the pulley, R, are the same as those used in the registering barometer of Redier; the one goes constantly to the right with an escape; the other to the left, with twice the speed of the first, and the extremity of the balance, by its motions, determining the freedom of the fan of the second wheel-work, which makes the pulley, P, turn in the desired direction.

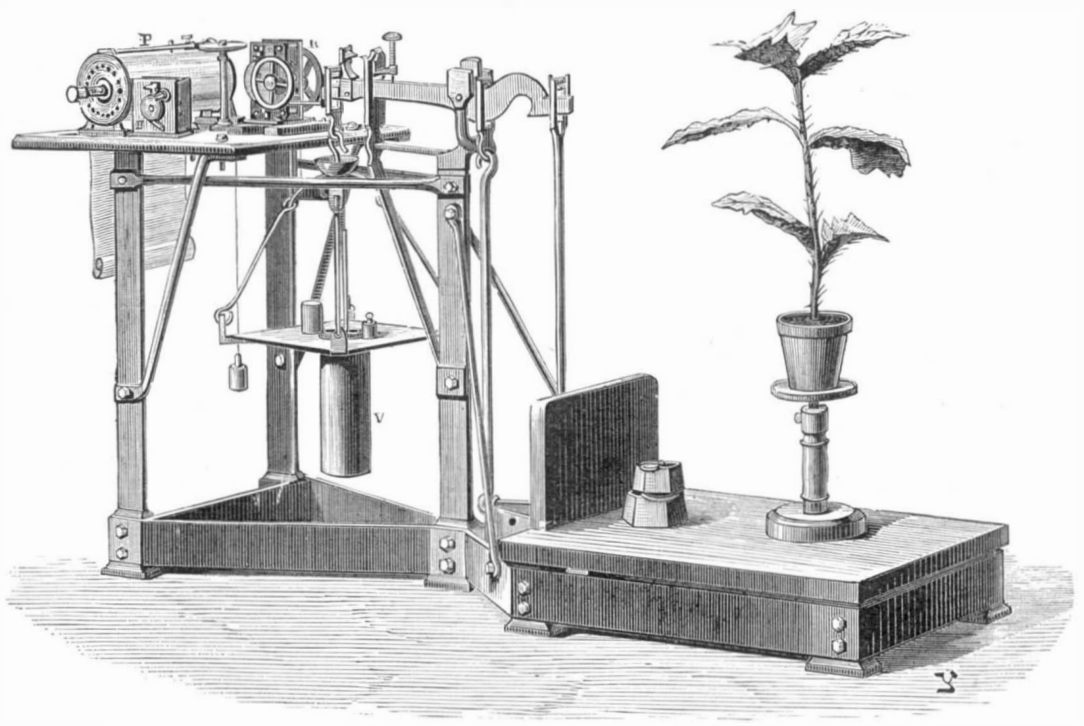


NEW STETHOSCOPIC MICROPHONE.

Several specimens of this balance have been successfully used for several months by Grandeau in his laboratory of the Western Agronomical Station. M. Grandeau has, with the help of this balance, undertaken a series of experiments on the evaporation of the soil and of plants. Our engraving represents the photograph of one of these experiments, and shows the platform scale ready to register the changes in weight of the plant standing on it.

In one of his late lectures at the Conservatoire of Arts and Trades, M. Mangon made the registering balance operate in a striking manner. A man sat on the platform scale; the curve traced by the apparatus indicated a certain diminution of weight, to which all living beings are subject during repose. When the curve was neatly traced, the man began to read aloud. The Mechanical part of the apparatus, as small as it is, at once indicated its sensibility; as soon as the reading began the curve changed its form, and indicated a greater loss of weight.

This instrument opens the way to a large series of studies upon the variations of weight of the human body, and also upon a great number of other not less important researches.



PLATFORM SCALE OF CONSTANT EQUILIBRIUM.

Two old rats were recently caught carrying off the eggs placed in a nest for a setting hen. They ran the lower jaw through the shell, raised the head slightly, and carried off the eggs with the greatest ease.

New Inventions.

Mr. Timothy Hawkes, of Jersey City, and John Hawkes, of New Brunswick, N. J., have patented an improved Feed Bag for Horses, which is so constructed that the top of the grain will always be in the proper position for the horse to eat conveniently, whether the bag be full, half full, or nearly empty.

Mr. John Lahmëyer, of Fort Wayne, Ind., has patented an improved Self-Coupler for Cars, and by which the link may be held in position for entering the drawhead of the next car, thus precluding the necessity and danger of introducing the link by hand, as heretofore done in coupling.

Mr. Lewis Want, of Golden, Col., has patented an improved Baby Walker. This invention consists in a novel construction of the framework of a baby walker, whereby facility is afforded for readily placing a child in position in the apparatus and removing it therefrom.

An improved Shutter has been patented by Mr. Asher Bijur, of New York city. This invention relates to improvements in the construction of the shutter for which Letters Patent have been granted to the same inventor January 22, 1878. By means of this improvement the slats may be adjusted with greater facility, and the manufacture and repairing of the shutter made cheaper and easier.

An improved Clasp has been patented by Mr. P. F. Tunny, of Greenbush, N. Y. The object of this invention is to provide an improved clasp for suspenders for supporting pantaloons without the use of buttons.

Mr. Joseph Clark, of Brooklyn, N. Y., has patented an improved Sewer Trap, in which the siphoning of the trap is prevented, the choking up of the same obviated, and the stench of the gases arising from the sewer neutralized to a certain extent.

Mr. Charles W. Pagett, of Keokuk, Iowa, has patented an improved Attachment to Curry Combs for cleaning the fetlocks and depressions of the limbs. The invention consists of a convexo-concave disk having radial teeth, the disk being secured by a clamp screw to the curry comb, so that it may be extended beyond the comb or be turned back out of the way.

An improved Broom has been patented by Mr. William Walter, of Arcadia, Washington Ter. The object of this invention is to furnish a broom so constructed that the brush when worn may be readily replaced by a new one.

An improved Lamp has been patented by Sarah Thomas, of Youngstown, Ohio. The object of this invention is to furnish, for use in rolling mills, sawmills, and manufacturing establishments in general, an improved lamp that is not liable to explosion, so as to expose the building to the danger of fire. The oil is supplied from a central reservoir of considerable capacity, and is forced into the different burners.

Mr. Charles Copman, of New York city, is the inventor of an improved Back Sink, of that class which are used in private residences and tenement houses, and are set back into recesses of the walls, so that the woodwork or partitions at the upper part of the recess may be put up, removed, and replaced with great facility, and without injury to the same, to facilitate repairs to the plumbing.

Mr. William Loudon, of Superior, Neb., has devised an improvement in Lift Pumps, which consists in operating the pistons through a rope or chain and a loose drum, which latter raises the piston to any suitable height by winding up the said rope or chain, the said drum being so constructed and arranged as to be thrown out of gear during a portion of its revolution, at which time the rope or chain unwinds and the piston rod and piston descend by gravitation.

Mr. Samuel Hedges, of Wheeling, West Va., has patented an improvement upon that form of Window Shade in which two rollers are employed, one at the top and the other at the bottom of the shade, to enable both ends of the same to be adjusted, the said shade being sustained by a tightened cord wrapped around the rollers, which, as the rollers are separately adjusted by an independent cord, serves to give, by frictional contact, the necessary rotary motion to wind or unwind the shade.

HARDENING OF COPPER AND ITS ALLOYS.—Everitt gives the following recipe: Melt together and stir until thoroughly incorporated, copper and from one to six per cent of oxide of manganese. The other ingredients for bronze or other alloys may then be added. The copper becomes homogeneous, harder and tougher.

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Business and Personal.

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Magic Lanterns and Stereopticons of all prices. Views illustrating every subject for public exhibitions. Profitable business for a man with a small capital. Also lanterns for college and home amusement. 74 page catalogue free. McAllister, Mf. Optician, 49 Nassau St., N.Y.

Vertical Engines, 10 to 15 H. P., thoroughly well made. John Hartrick & Co., 47 Gold street, New York.

The genuine Asbestos Steam Pipe and Boiler Coverings are the most durable, effective, and economical of any in use. H. W. Johns Manufacturing Company, 87 Maiden Lane, New York, are the sole manufacturers.

Manufacturers of Improved Goods who desire to build up a lucrative foreign trade, will do well to insert a well displayed advertisement in the SCIENTIFIC AMERICAN Export Edition. This paper has a very large foreign circulation.

For Power&Economy,Alcott's Turbine,Mt.Holly,N.J.

$500 will buy entire right of my Patent Hose Clamp. Something new. A rare chance. Address S. C. Smith, Norristown, Pa.

Eagle Anvils 9 cents per pound. Fully warranted.

The Forster-Firmin Gold and Silver Amalgamating Company, of Norristown, will repeat the highly successful trials of their system at the Eagle Works, adjoining the Depot. Norristown, Pa., on Sept. 27 and Oct. 1, 4, and 8. The first series of three public trials just concluded gave 99 per cent of silver and 98 to 99½ per cent of mercury recovered within one hour. For cards apply to the Company as above.

Useful Books for Engineers and Mechanics. Catalogues free. E. & F. N. Spon, 446 Broome St., New York.

For Sale.—A Foucault's Electric Regulator or Lamp; in perfect order. Address A.C.Hubbard, Danbury, Ct.

The New York office of the well known Berryman Feed Water Heater and Purifier is located at No. 97 Liberty St. H. T. Brewster, Manager.

Magneto Call Bells for Telephone Lines. The Best. No battery required. Bunnell, 112 Liberty St., N. Y.

Manufactured Articles and Specialties introduced to Trade and Consumers. Cash paid. J.N.Gerard, Manuf. Agent, 174 Pearl St., New York.

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Kreider, Campbell & Co., 1030 Germantown Ave., Phila., Pa., contractors for mills for all kinds of grinding.

Wheels and Pinions, heavy and light, remarkably strong and durable. Especially suited for sugar mills and similar work. Pittsburgh Steel Casting Company, Pittsburgh, Pa.

The Lawrence Engine is the best. See ad. page 237.

Try Penfield Tackle Block Works, Lockport, N. Y.

For the most substantial Wood-Working Tools, address E. & F. Gleason, 52 Canal St., Philadelphia, Pa.

Bevel Protractor.—Patent for sale. Combines several drawing tools. F. L. Cook, Fairfield, Iowa.

Wheelbarrows.—Over 50 styles, with felloe-plated, bolted wheels. Pugsley & Chapman, 8 Liberty St., N.Y.

Notice.—Charles N. Elliott, of N. Y., is no longer connected officially with the Ingersoll Rock Drill Company, and is not authorized to collect moneys or transact any business whatever for the same.

Exhibition Magic Lantern and 60 Views, only $25. Catalogue free. Outfits wanted. Theo. J. Harback, Importer and Manufacturer, 809 Filbert St., Phila., Pa.

The improved Gatling Guns fire over 1,000 shots per minute, and are the most destructive war weapons ever invented. Gatling Gun Co., Hartford, Conn., U.S.A.

Blowers.—One No. 5, two No. 6, regular pattern, steel, pressure Sturtevants; one No. 6, Hot Blast Apparatus; also other sizes for sale very low. Exeter Machine Works, 140 Congress St., Boston, Mass.

Band Saws, $100; Scroll Saws, $75; Planers, $150; Universal Wood Workers and Hand Planers, $150, and upwards. Bentel, Margedant & Co., Hamilton, Ohio.

Howard's Bench Vise and Schleuter's Bolt Cutters, Howard Iron Works.

Twenty-five per cent saved by use of H. W. Johns' Asbestos Liquid Paints.

The only Engine in the market attached to boiler having cold bearings. F.F.& A.B.Landis, Lancaster, Pa.

James T. Pratt & Co., 53 Fulton St., N. Y. Scroll Saws and Designs. Send for circular.

North's Lathe Dog. 347 N. 4th St., Philadelphia, Pa.

Best Turbine Water Wheel, Alcott's, Mt. Holly, N. J.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Use the Patent Improved Sheet Iron Roofing and Drip Crimped Siding made by A. Northrup & Co., Pittsburg, Pa. Send for circular and prices.

Nickel Plating.—A white deposit guaranteed by using our material. Condit,Hanson & Van Winkle,Newark,N.J. English Agency, 18 Caroline St., Birmingham,

J. C. Hoadley, Consulting Engineer and Mechanical and Scientific Expert, Lawrence, Mass.

Boilers ready for shipment, new and 2d hand. For a good boiler, send to Hilles & Jones, Wilmington, Del.

Punching Presses, Drop Hammers, and Dies for working Metals, etc. The Stiles & Parker Press Co., Middletown, Conn.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

The Asbestos Roofing is the only reliable substitute for tin, it costs only one half as much, is fully as durable, and can be easily applied by any one. H.W. Johns Manufacturing Company are the sole manufacturers.

Alcott's Turbine received the Centennial Medal.

Mill Stone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau St., N. Y.

Safety Linen Hose and Rubber Hose for all purposes at the best rates. Greene Tweed & Co., 18 Park Pl., N. Y.

Presses, Dies, and Tools for working Sheet Metals, etc. Fruit and other Can Tools. Bliss & Williams, Brooklyn, N. Y., and Paris Exposition, 1878.

Pulverizing Mills for all hard substance and grinding purposes. Walker Bros. & Co., 23d and Wood St., Phila.

The Cameron Steam Pump mounted in Phosphor Bronze is an indestructible machine. See advertisement.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Dead Pulleys, that stop the running of Loose Pulleys and Belts, taking the strain from Line Shaft when Machine is not in use. Taper Sleeve Pulley Works, Erie, Pa.

Return Steam Trap, now in the market. Patent for sale. Send for circulars. Engineer, 555 Broadway, N.Y.

Emery, Glue, Vienna Lime, and all polishing goods. Greene, Tweed & Co., 18 Park Place, N. Y.

Notes & Queries

(1) H. J. asks: Could telegraph wires run through the oil pipes in the Pennsylvania oil regions be worked successfully, and without igniting the oil? A. Yes.

(2) C. A. W. asks: 1. Has a person the right to manufacture a phonograph as described in SCIENTIFIC AMERICAN SUPPLEMENT No. 133, or is it patented? Also, has a person the right to manufacture a telephone, using a box like Bell's and the ferrotype disk? A. See "Rights of Investigators" in No. 7 of current volume of SCIENTIFIC AMERICAN. 2. I made one exactly like the one described in said SUPPLEMENT, figures 3 to 7 inclusive, and it does not reproduce. What can be the matter with it? A. If you have carefully followed the directions, it should work. We think the trouble is in the damping of the diaphragm.

(3) M. G. writes: I wish to make an apparatus to compress oxygen gas in tanks without the aid of pumps. The following is the description of my arrangement: I have a tank capable of holding 30 feet of gas under a pressure of 600 lbs.; attached to its stopcock is a retort, standing the same pressure, filled with chemicals. I heat the retort, and the gas by its own pressure is forced from the retort into the tank. Now I would like you to inform me if this arrangement would fulfill its purpose, and if the gas in the retort would force its way into the tank. A. There are similar devices for generating oxygen under pressure in the market, but owing to the necessity of heating the retort nearly or quite to redness, the experiment is not a very safe one. Oxygen derived from potassium chlorate should be thoroughly washed before storing it in either iron or copper tanks. With a good head of water the gas may be readily compressed several atmospheres by hydrostatic pressure.

I would like to know if there is any means to find focus of a reflector (concave mirror) aside from practice, as I have practiced for several months and never found it. A. If the reflecting surface is a portion of a sphere, the principal focus will be found at a point on the axis midway between the surface of the mirror and the center of the sphere which the mirror would form if it were extended with uniform curvature.

(4) D. G. writes: I would like to know the proportion of power required to move the valve compared with same power to do the necessary work of engine; thus, if 20 horse power is required for engine work, how much additional is needed to shift valve for feed? A. It is ordinarily considered that the friction of valve, etc., is equivalent to a pressure of from 1 to 2 lbs. per square inch of piston area. This, of course, is only approximate, as the exact amount in any particular case must be determined by experiment.

(5) N. M. D. asks: What will purify cistern water that is stagnant? A. The well should be pumped dry and thoroughly cleaned. Under the circumstances it would not be safe to attempt the purification of the water.

(6) H. L. asks (1) for a recipe for keeping brass clean. I have a microscope, and I wipe it every time I use it, but it gets rusty. A. Clean and polish the work, warm it, and while warm apply a uniform film of one of the following lacquers: 1. Shellac, 3 ozs.; turmeric, 1 oz.; dragon's blood, ¼ oz.; alcohol, 1 pint. Digest for a week, with occasional stirring, decant and filter. 2. Digest in separate portions of wood naphtha or wine spirits an excess of turmeric and dragon's blood; dissolve shellac in 5 parts of alcohol or wood naphtha (methylic alcohol), and color with the above tinctures (filtered) to suit. 3. Dissolve in about 12 ozs. alcohol ½ oz. shellac, 1 drachm dragon's blood, and ¼ drachm turmeric root. It is sometimes necessary to filter the varnish. It is applied as usual. At first the varnish will seem to be a failure, but in a short time it will have a beautiful gold color. 2. Will chloride of calcium in the box absorb the moisture and keep it bright? A. A small vessel of quicklime will answer better.

(7) C. G. L. & C. C. ask: 1. Are the railroad cars on any of the roads lighted with gas? A. Yes. 2. If so, is the gas taken on at towns on the road, or is it manufactured on the car? A. A sufficient quantity of gas for a trip is forced into an iron cylinder suspended underneath the car, and it is supplied to the burners through a pressure regulator.

(8) W. H. R. writes: Some time since, having occasion to make some repairs on a two flued boiler at a coal mine at Cadiz, O., the following occurrence took place: The leak being on the side rather than on the bottom of boiler; after knocking a hole some 12 inches in diameter inside of boiler, allowing water to run out (the water being cold, having been standing for 3 days and nights with no fire under boiler). We then proceeded to take the "man head" out, so as to make an examination of flues and interior of boiler. At least one hour had elapsed since breaking hole in side of boiler, and when a lighted torch was presented to the man hole an explosion took place of some kind of gas contained in boiler. There was quite a rush of air or gas outward, very much like retorts at gas works when they are opened and touched off with hot iron, or like blast from a pressure blower. The flame was of a bluish white color and lasted about 5 or 6 seconds. The water used in boiler was very strongly impregnated with sulphur, being the water pumped from the mine. A. Hydrogen sulphide mixed with air explodes upon ignition. The light gas dissolved in water is eliminated therefrom on boiling, and collects at the highest points in the boiler.

(9) P. P. writes: I would like to know what water glass is made of, how made, and what it is used for. A. Fuse silica (by heat) with twice its weight of anhydrous sodium carbonate. The glasslike product dissolves in boiling water. Used for rendering wood and fabrics less combustible; for making artificial stone, various cements, fireproof varnishes, paints, etc.

(10) C. N. S. asks: In a storage warehouse will it take more ice to keep the temperature at 40° Fah. than it will 50°? If so, why? A. Yes. Bodies radiate their heat in all directions, and receive the heat radiations of surrounding bodies. If the latter absorb more heat than they radiate in return, the bodies from which they receive it are proportionately impoverished or refrigerated, so that a body surrounded by ice will be colder than one only partially surrounded thereby, other things being equal.

(11) S. D. M. asks: Do freezing mixtures in which ice is not used reduce the temperature by evaporation? A. No; in such cases the substances are frozen in consequence of their own uncompensated radiation.

1. For the same increment of heat, is not the vapor of alcohol more elastic than steam? A. Above the point of maximum density, no. 2. Is it condensed as readily as steam? A. Yes.

(12) R. V. G. asks: 1. What is the most powerful spring that can be made? A. We do not know that there is a limit to the power. 2. What springs compress or expand the most in proportion to their load and power? A. Tempered steel springs. 3. In "Science Record" for 1875, p. 319, I find that springs can be made that will exert a pressure of 800 or 900 lbs. Has there been any improvement since then? A. We think not. 4. What is the distance that the periphery of the spring barrel will travel in this spring? A. This can be arranged as desired. 5. What is this 800 or 900 lbs., the greatest pressure exerted, or the medium? A. The mean. 6. What was M. Lereaux's success with his spring propelled cars? A. The cars have not become commercially successful. 7. Can a rubber spring, or a combination of rubber springs, be made that will compress two or more feet, and what is the rule for computing the load that they will sustain and their compression? A. Yes. The load must be determined by experiment. 8. What is the strongest cylinder coiled wire spring that can be made, and what would be its expansion? A. A spring can be made as strong as desired by increasing its size, and the expansion can be varied in the same manner. 9. What is the rule for computing the load a cylinder coiled spring will sustain, and its expansion? A. Such data are usually obtained by experiment, as there are many elements which cannot be accurately introduced into a general formula.

(13) W. H. S. asks (1) how to fasten rubber to wood. A. Melt together in a suitable iron vessel, over a gentle fire, equal parts of pitch and gutta percha. Use warm. 2. Is saltpeter or sugar injurious to rubber? A. If the rubber is vulcanized they will have little or no effect at ordinary temperatures.

(14) W. A. P.—See recipes given W. H. S. and others, on this page.

(15) C. F. P. writes: With reference to acoustic telephone figured and described in a late issue, please answer several inquiries: 1. What should be the size of rubber bands used at the turns? A. The smallest size. 2. How many turns may be made in a line of 100 feet, without injuring its efficiency? A. We think 4 or 5. 3. Is a small wire as good or better than a string, and does it need as much tension? A. No. 4. What is the proper mode of hanging and making turns when a wire is used? A. Hang the wire on short strings. 5. How can the inconvenience of a hole for wind and storm to enter the room be got over, in using this kind of a telephone? A. By covering the hole with very thin rubber and running the thread through a needle hole in the rubber.

(16) J. L. S.—See p. 107 (12), vol. 37, SCIENTIFIC AMERICAN.

(17) G. F. P. writes: During the eclipse of last month, which was only partial with us, I noticed that the light that passed through the tree tops to the ground were all of a crescent shape, with the points of the crescent pointing north without any exception. A. A beam of light from the sun falling through a small aperture of any shape forms on the object upon which it rests a luminous disk, which is the image of the sun. The tree was virtually a screen with a number of small apertures, and the crescent shaped images were so many pictures of the sun. Diminished light during the eclipse is favorable to the formation of these images, and an image of the sun's full disk is best projected on a hazy day.

(18) O. H.—See reply to (25), "Notes and Queries," in No. 7 of current volume.

(19) C. W. R.—See reply to (18), "Notes and Queries," in No. 9 of current volume.

(20) M. C. asks: 1. Will sulphuric acid corrode iron so as to injure pipes? If so, can it be counteracted by washing with any other mixture, and what is it? A. Yes. Strong, cold sulphuric acid does not corrode dry iron surfaces rapidly: it is advisable, however, not to let it remain in contact therewith more than a few minutes. It may be removed by washing with plenty of water, and the last traces neutralized by dilute solution of alkali or sal soda. 2. If washing after using the sulphuric acid is not needed for the safety of the pipes, would any vapor arising from them when heated be injurious to plants? A. It would be requisite to wash the pipes thoroughly and dry them after such treatment.

What effect, if any, has carbolic acid on plants or on insects injurious to them? A. If used in sufficient quantity, it would prove destructive to both.

(21) G. H. asks how to make potato farina. A. Select fine potato starch and reduce it, by milling, to the condition of flour. Potato flour is a commercial article.

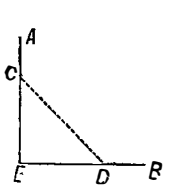
(22) T. P. F. asks: 1. How many cubic feet of air at 200 lbs. pressure would it take to supply two men in a cylinder, 15 feet long and 5 feet diameter, for 24 hours? A. A man requires about 215 cubic feet of air, at ordinary pressure, per hour, or between 16 and 17 cubic feet at 200 lbs. pressure. 2. Is there any way to take up the carbonic acid exhaled? A. Caustic lime, potassa or soda absorbs carbonic acid. About 54 lbs. (in practice perhaps 5 times that amount) of caustic lime would be required to completely absorb the carbonic acid eliminated by two men per hour under such conditions. 3. Is there any way to manufacture air, so that a man could live in an airtight cylinder for a few days? If so, how? A. No. The quantity of oxygen (the nitrogen is not absorbed) required would be—under 200 lbs. pressure—nearly 7 cubic feet per hour.

(23) J K. P. writes: Some time ago I saw in the SCIENTIFIC AMERICAN that an excellent and harmless hair dye could be made of green walnuts. Will you be good enough to tell me how the dye is made, the proportions of each ingredient, and the manner of working, etc.? A. Use the expressed juice of the bark or hulls of the green walnut (Paulus ægineta). See p. 107 (19), vol. 38, SCIENTIFIC AMERICAN.

(24) A. M. R. asks: Is there a metal that will melt at a heat low enough to form castings in iron moulds, the metal, alloy, or compound to be strong enough to make a strong nut for bolts, slightly or very elastic? A. As we understand you, no.

(25) J. A. W. asks: Can you explain why steam from sea water will melt Babbitt metal when fresh water steam will not? I have a small steamboat (3 tons); the piston has a Babbitt ring, and twice salt water has been used in the boiler, and both times it has melted the ring. A. We think it probable that the trouble is caused by a higher temperature than is usual with fresh water, but cannot form any decided opinion from the data sent.

(26) A. B. writes: Will you please inform me of the correct way to draw a true square for the foundations of or for setting double engines? How can I determine when A is square with B, if C and D are each 10 feet from E? What should be the distance from C to D? Is there not a rule to determine that for any dimensions? A. The distance from C to D is the square root of CE^2+DE^2. We do not remember having seen such a book as you require.



(27) H. D. O'B. asks: What will make kerosene oil (crude or refined) thicker or heavier? Please state in the order of cheapness. A. Paraffin oil, lard oil, Venice turpentine, etc.

(28) R. H. W. and others.—Trinitrocellulose may be prepared by steeping clean dry cotton wool for a few minutes in a mixture of pure fuming sulphuric and nitric acids (nitric acid—specific gravity 1·5—3 parts; sulphuric acid—specific gravity 1·84—6 parts, squeezing, thoroughly washing in running water, and carefully drying it at a very gentle heat. But to secure uniformity and render the produce less liable to spontaneous decomposition the following precautions are necessary: 1. The thorough cleaning and drying of the cotton previous to its immersion in the acids. 2. The steeping of the cotton in a fresh mixture of acids (the strongest procurable in commerce) after the first immersion for 24 hours or more. 3. The purification of the product by washing it in a stream of water for several days and subsequently, before finally drying it, in a weak (3 or 4 per cent) solution of alkali or sodium carbonate.

(29) C. W. C. asks: What should be the speed of a saw in a scroll saw; sawing ¼ inch walnut, stroke 1¼ inch? A. A good speed is 900 to 1,000 strokes per minute.

What is putty powder? A. Ignited stannic oxide (oxide of tin).

(30) B. wants to know what will kill cockroaches and bed bugs. A. See pp. 171 (1), vol. 38, and 299 (25), and 69, vol. 37, SCIENTIFIC AMERICAN. A little turpentine or kerosene oil is among the best of exterminators for the latter.

(31) H. M. H. asks for a recipe for making an oil finish for walnut doors that will stand the weather. Also a recipe for a walnut stain. A. See pp. 59 (4), 172 (32), and 283 (14), SCIENTIFIC AMERICAN, vol. 38.

(32) C. E. G. asks for the simplest process of bleaching shellac. A. Boil the shellac with about ¼ its weight of caustic potash in 3 or 4 volumes of water, and when dissolved filter and pass chlorine through it in excess; wash and digest the precipitate with water. Softened by heat.

(33) H. D. M. writes: I put a cask in the water, and make a mark on it, to show how far it sinks in the water. If I fill the cask with air compressed to 3 or 4 atmospheres and put it in the water again, will it rise or sink below the mark? A. It will sink.

(34) B. P. writes: 1. I have two bar magnets ¾ by 4 inches. Can I use them to make some magnetic telephones? A. Yes. 2. If so, how much of No. 40 silk covered copper wire must I use? A. Use 1 oz. of wire. 3. How large shall I make the diaphragms? A.

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About 1¾ inch. 4. I have some tintype plate. Will this do for the diaphragms? A. Yes.

(35) D. A. R. asks if the Manetto or the Thompson battery, or any other modification of the same, can be used on open circuit. If not, will you please inform me of any form that may be so used, dispensing with the liquid? My object is to attain some form of battery that may be carried about, and at the same time work on open circuit. A. A Léclanché battery would probably suit your purpose. You might use a moist pile, consisting of a number of disks of copper and zinc separated by disks of pasteboard and arranged thus: copper, zinc, pasteboard; copper, zinc, pasteboard, etc. The pile should begin with one metal and end with the other. Saturate the pasteboard with brine.

(36) W. L. J. asks: Is there any method of hardening lead after moulding? A. As we understand you, no.

1. Can additional light from the same jet be given by using a conical reflector? A. No; but all of the light may be thrown in one direction. 2. What amount of heat will the common reflectors now in use stand without being destroyed or unfit for use? A. A metallic reflector will stand all that is required. 3. Of what materials are these reflectors constructed? A. Of silver plated metal or silvered glass.

(37) E. A. K.—The amount of water in fine wheat flour is usually about 10 per cent. Potato flour usually contains from 8 to 12 per cent, and somewhat whiter.

(38) W. & D. ask: 1. Will you please inform us of the fastest speed ever attained by a locomotive and a train, either on this continent or on the other? A. This is a disputed point, which we think has never been satisfactorily settled. 2. Will you also tell us where we can find a description of the largest locomotive in the world? A. See SCIENTIFIC AMERICAN, August 15, 1874, p. 100.

(39) W. E. B. asks (1) for information about galvanizing gray iron. A. See p. 139 (12), current volume, SCIENTIFIC AMERICAN. 2. Also give a recipe for tinning iron, etc. A. The articles must first be thoroughly annealed while excluded from the air, and when cold submitted to a hot dilute pickle of sulphuric acid. After the oxide is removed they should be cleansed in water. When dry, plunge them in a bath of hot palm oil, and when heated to the temperature of the oil (about 200° Fah.) immerse quickly in a bath of melted tin covered with the oil. Remove and drain. To obtain a thicker coat of tin submerge again in the tin bath, heated but little above the melting point. Small articles of brass or copper are tinned by boiling with a strong aqueous solution of potassic stannate, or with tin filings and solution of cream of tartar or caustic soda.

(40) D. C. asks: Can water be congealed or hardened so as to be unaffected by a moderate heat? I have seen, in caves in Bermuda and elsewhere, a stony substance formed by dripping water. Is this formed by the gases of which the water is composed, undergoing a chemical process caused by the nature of the materials forming the surroundings of the cave, or is it simply an accumulation of particles of matter which the water gathers in its course? A. No. Water containing lime carbonate in solution deposits a portion of it on free exposure to air. The stalactites and stalagmites seen in caves consist of lime carbonate deposited in this way from water trickling through the roof of the cave.

(41) F. D. T. asks for a recipe for making artificial whisky without alcohol. A. Whisky cannot be made without alcohol.

(42) M. M. asks how to clean or bleach ivory that has become stained or yellow from exposure or handling. A. Ivory is whitened or bleached by rubbing it with finely powdered pumicestone and water, and exposing it to the sun while still moist, under a glass shade to prevent desiccation and the occurrence of cracks. Repeat the process until the proper effect is produced. Ivory may also be bleached by immersion for a short time in water holding a little sulphurous acid, chloride of lime, or chlorine in solution; or by exposing to the fumes of burning sulphur, largely diluted with air. Where the ivory keys cannot be removed the polishing process may be the best.

(43) C. H. F writes: If a man should leave Chicago, Ill., at 12 o'clock Monday noon, and travel west around the earth at the same rate of speed as the earth revolves on its axis, he arriving in Chicago at 12 o'clock Tuesday noon, where would he first have passed people to whom it had been Tuesday noon? A. We believe that sailors make the change near the coast of Asia.

(44) S. G. writes: I have a high pressure engine, 12 inches bore, 20 inches stroke, running 90 revolutions per minute. The pulley on the main shaft driving the governor is 9 inches in diameter. The pulley on the governor is 10 inches in diameter. I wish to speed this engine to run 120 revolutions per minute. What size pulley will I need to put on the governor? The governor is Judson's patent. A. About 13⅓ inches diameter if the governor is running at the right speed with the present arrangement. You will find the proper speed stamped on the governor, and should proportion the pulleys so as to give this speed when the engine is running 120.

(45) C. H. H. asks how he can make a good dressing and polish for leather. A. See pp. 60 (10), 220 (43), 300 (45), vol. 38, and 91 (21), current volume, SCIENTIFIC AMERICAN.

How is liquid glue made? A. Dissolve fine glue in a small quantity of strong acetic acid.

1. How can I make a good writing ink? A. See pp. 76 (15), vol. 38, and 76 (54), 123 (15), 327, 299 (18), 300 (61), and 124 (49), vol. 37, SCIENTIFIC AMERICAN. 2. Is there anything that can be added to make it a copying ink? A. A little sugar.

(46) J. F. asks: How is celluloid made? A. Celluloid is a kind of solidified collodion. It is composed of some fibrous material, such as cotton, which is dipped in sulphuric and nitric acids. The cotton then possesses the quality of solubility and sudden explosion, and is termed gun cotton or pyroxylin. When this is dissolved in ether and alcohol it is called collodion, and is used in photography. Celluloid is made by using camphor in place of alcohol and ether, in connection with pyroxylin. The pyroxylin is ground to a pulp with water. It is then strained to expel the water, and pressed into a mass. Gum camphor is ground with water and thoroughly incorporated with the pulp, one part, by weight, of camphor being used to two parts of the pulp. The mass is then put in a mould and subjected to powerful pressure, and heated while under this pressure from 150° to 300° Fah.

(47) A. B. H. asks (1) for the best kind of oil to use to keep a gun from rusting. A. Clean the barrel occasionally and cover the exposed portions of the metal with a film of linseed oil. 2. What is best for lubricating the lock, etc.? A. Purified olive or sperm oil.

(48) W. H. P. asks how to etch on steel. A. The clean plate must be covered with an even film of wax, either applied while the heat is uniformly heated, or dissolved in alcohol and flowed on the warm plate. The etching fluid may be made as follows: Pyroligneous acid 4 ozs., alcohol 1 oz., nitric acid 1 oz., by measure. Or use iodine 1 oz., iron filings ½ drachm, water 4 ozs. The lines are cut through the wax with a fine steel point, so as to leave the metal surface bare under the lines. The etching fluid is then poured on, and removed as soon as the metal is sufficiently etched.

(49) C. W. W, asks what to use to make muslin and paper for small balloons fireproof or airtight. A. The fabric may be rendered uninflammable by soaking it in a strong aqueous solution of commercial sodium tungstate and drying. For airtight varnishes, etc., see p. 268, vol. 36, SCIENTIFIC AMERICAN.

(50) C. F. H. asks: What is the substance mostly used for coloring butter, and also state the simplest test for its detection? A. Annatto is very often employed; when pure it is not detrimental to health; but it is often adulterated with red lead and ocher. Examine several portions of the sample under a good microscope, using a ¼ or ⅛th inch objective. In pure butter nothing is seen except the characteristic fatty globules and granular masses of curd and the cubical crystals of salt. If the butter has been artificially colored, the coloring matters as well as farinaceous and other common adulterants may be distinguished as distinct from the butter.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. P. and W. J. P.—An impure micaceous and silicious clay (aluminum silicate) of little value.—T. M.—It is a rich ore of iron containing zinc blende. A quantitative analysis would be necessary to determine its precise value.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

Meteoric Phenomena. By D. E. W.
The Crank Motion. By E. H.
Celestial Machine. By G. V.
An Astronomical Law. By H. L.
The Sensitive Flame as a Microphone. By W. L. S.
The Electrical Indicator for showing the Rotation of the Earth and the Micro-Telephone. By A. E. D.
The Micro-Telephone. By T. J. F.
The Metamorphosis of the Barnacle. By G. K.
Hack Horses and Chemistry. By W. P. W. D.
Spider and Potato-bug. By R. B. F.
Flow of Water through Pipes. By R. G.
Fuel Saving. By R. G.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Many of our correspondents make inquiries which cannot properly be answered in these columns. Such inquiries, if signed by initials only, are liable to be cast into the waste basket.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

July 30, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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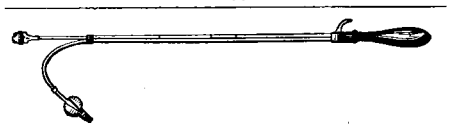
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.



No Matches or Electricity Required.
Agents wanted everywhere. The Self-lighting Gas Torch pays a handsome profit. Address
STOCKWELL SELF-LIGHTING GAS BURNER CO.,
89 Liberty Street, New York.

Jacksonville Water Works.

SEALED PROPOSALS will be received by the Trustees of the Sanitary Improvement Bonds of the City of Jacksonville, Florida, until 12 o'clock noon of Monday, the 21st day of October next, for furnishing all necessary material and constructing Water Works for said city, said works to be either with stand pipe or by direct supply, and of sufficient capacity to furnish not less than two million gallons every twenty-four hours. Two engines will be required, each of sufficient capacity to supply one and one-half million of gallons daily. The works to be first-class in material and construction. Bids will be received for the whole work, or separate parts thereof. The Trustees reserve the right to reject any and all bids. For printed circular, with specifications and all other necessary information, apply to
A. S. BALDWIN, Chairman, Jacksonville, Fla.

ANY LADY or Gent that sends us their address will receive something of great value free, by mail. Only about 200 left.
M. YOUNG, 173 Greenwich St., New York.

REGISTERED TRADE MARKS
"Phosphor-Bronze."
Phosphor-Bronze, for General Machine Castings, Pinions, Cog Wheels, Propeller Screws, Hydraulic Press and Pump Barrels, Piston Rods, Screw Bolts for Steam Cylinders, Hardware, Bearings, Valves, Bells, Steam Whistles, Hammered Piston Rods, Wire, Rods, Sheets, Bolts, Tubes, Plates, etc. Apply to THE PHOSPHOR-BRONZE SMELTING CO., Limited, 2038 Washington Ave., Philadelphia, Pa., Sole Manufacturers in U. S.

The Genuine Baxter Steam Engines,
Made exclusively by
COLTS FIREARMS COMPANY
Of HARTFORD, CONNECTICUT,
And sold only by them and their authorized Agents. Sizes from 1 to 15 horse power, including Engine and Boiler and everything complete to run. Non-explosive; occupies less space and consumes less fuel than any other engine. Beware of Imitations offered by other parties. For prices and particulars, apply to
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and Shaped Diamond Carbon Points, indispensable for Truing Emery Wheels, Grindstones, Hardened Steel and Paper Calendar Rollers, Drilling, Planing, Moulding and Sawing Stone. J. DICKINSON, 64 Nassau St., N. Y.

MACHINERY AT VERY LOW PRICES.
2d hand Lathes, Drills, Planers, Hand Tools for Iron Work. new Woodworth Planing Machines, Resawing, Tenoning, Moulding Machines, Scroll Saws, Portable Steam Engine. Jos. R. Blossom, Ass'e, Matteawan, N. Y.

TURBINE WATER WHEELS.
New pattern. Increased percentage of power given. Estimates given on all kinds of Mill Machinery.
O. J. BOLLINGER, York, Penn.

TELEPHONES,
Perfect working, at reduced prices. Send for illustrated circular to TELEPHONE SUPPLY CO.,
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RUPTURE BAND, worn night and day. $2.50
Best Elastic Truss; half usual price. Made to order. Best material and workmanship. For circular address L. F. de Lesdernier, 48 Broad St., N.Y.

Portable Steam Engines
With Automatic Cut-off.
No Commissions to Agents.
Bottom Prices to Purchasers.
SEND FOR CATALOGUE.
Armington & Sims
A. & S. were lately with
THE J. C. HOADLEY COMP.

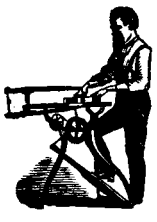
NICKEL.
YATES NICKEL WORKS,
136th St., near 3d Ave. YATES & ELY, Proprietors. Our Pure Nickel Anodes dissolve like a silver plate, without crumbling. Their purity makes them especially valuable for plating jewelry, or where extra whiteness and finish is required.

MINING MACHINERY. Engines, Boilers, Pumps, Coal and Ore Jigs, Dust Burning Appliances. Drawings and advice free to customers. Jeanesville Iron Works (J. C. Haydon & Co.). Address HOWELL GREEN, Supt., Jeanesville, Luzerne Co., Pa.

DYKES' BEARD ELIXIR
A Wonderful Discovery. Forces heavy Moustache or Beard even on smooth faces in from 20 to 30 days. These cuts are from the original, and show a positive result from its use. It works like magic and never fails. No possible injury to the skin, easily applied and certain in effect. Pkg post-paid 25 cts. 3 for 50 cts. L. L. SMITH & CO. Sole Ag'ts, Palatine Ill. All others counterfeits.

Wrought Iron Pipe and Fittings, Valves, Steam Cocks, &c.
Albert Bridges, No. 46 Cortlandt St., New York.

ADVERTISING
YOU PAYS WHEN PROPERLY PLACED.
Can have your Advertising properly placed through
C. K. HAMMITT'S Advertising Agency,
206 Broadway, New York.
Send stamp for catalogue of Scientific, Mechanical, Agricultural, Trade, Religious, Sunday-school, Foreign, Daily and Weekly Papers.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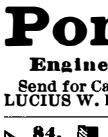
13 Different machines with which Builders, Cabinet Makers, Wagon Makers, and Jobbers in miscellaneous work can compete as to QUALITY AND PRICE with steam power manufacturing; also Amateurs' supplies. MACHINES SENT ON TRIAL.
Say where you read this, and send for catalogue and prices.
W. F. & JOHN BARNES,
Rockford, Winnebago Co., Ill.

BLAKE'S STONE AND ORE BREAKER AND CRUSHER.

For breaking hard and brittle substances to any size. Endorsed by the leading Mining, Manufacturing, and Railroad corporations in the United States and Foreign Countries. First Premium wherever exhibited, and hundreds of testimonials of the *highest character*.
A NEW SIZE FOR PROSPECTING AND LABORATORY USE.
☞ ALL STONE CRUSHERS not made or licensed by us, containing vibratory convergent jaws actuated by a revolving shaft and fly-wheel, are infringements on our patent, and makers and users of such will be held accountable. Address
BLAKE CRUSHER CO., New Haven, Conn.

The George Place Machinery Agency
Machinery of Every Description.
121 Chambers and 103 Reade Streets, New York.

Pond's Tools,
Engine Lathes, Planers, Drills, &c.
Send for Catalogue. DAVID W. POND, Successor to LUCIUS W. POND. Worcester, Mass.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For Business Purposes, ours excel all others in clearness and volume of tone. Illus. circular and testimonials for 3 cts.
Address J. R. HOLCOMB, Mallet Creek, Ohio.

SPARE THE CROTON AND SAVE THE COST.
Driven or Tube Wells
furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 414 Water St., N.Y., who control the patent for Green's American Driven Well.

WROUGHT IRON BEAMS & GIRDERS
THE UNION IRON MILLS, Pittsburgh, Pa., Manufacturers of improved wrought iron Beams and Girders (patented).
The great fall which has taken place in the prices of Iron, and especially in Beams used in the construction of FIRE PROOF BUILDINGS, induces us to call the special attention of Engineers, Architects, and Builders to the undoubted advantages of now erecting Fire Proof structures; and by reference to pages 52 & 54 of our Book of Sections—which will be sent on application to those contemplating the erection of fire proof buildings—THE COST CAN BE ACCURATELY CALCULATED, the cost of Insurance avoided, and the serious losses and interruption to business caused by fire; these and like considerations fully justify any additional first cost. It is believed, that, were owners fully aware of the small difference which now exists between the use of Wood and Iron, in many cases the latter would be adopted. We shall be pleased to furnish estimates for all the Beams complete, for any specific structure, so that the difference in cost may at once be ascertained. Address
CARNEGIE, BROS. & CO., Pittsburgh, Pa.

18 ELEGANT New Style Chromo Cards, with name, 10c., postpaid. GEO. I. REED & CO., Nassau, N. Y.

NEW METHOD OF ENGRAVING
Moss' Process.
Photo Engraving Co.
67 Park Place, New York.
L. SMITH HOBART, President. JOHN C. MOSS, Superintendent.

TYPE-METAL RELIEF PLATES.
A SUPERIOR SUBSTITUTE FOR WOOD-CUTS
AT MUCH LOWER PRICES.

Persons desiring illustrations for Books, Newspapers, Catalogues, Advertisements, or for any other purposes, can have their work done by us promptly and in the best style.

Our Relief Plates are engraved by photo-chemical means; are mounted on blocks type-high ready for use on any ordinary press, and will wear longer than the common stereotype plates.

They have a perfectly smooth printing surface, and the lines are *as deep*, *as even*, and *as sharp* as they could possibly be cut by hand.

Electrotypes may be made from them in the same manner as from wood-cuts.

Copy. The engraving is done either from prints or pen-drawings. Almost all kinds of prints can be re-engraved directly from the copy, provided they be in *clear*, *black lines* or stipple, and on *white* or only slightly tinted paper.

Pen drawings, suitable for engraving by us, must be made with *thoroughly* BLACK ink, on *smooth*, *white* paper. They should usually be made twice the length and twice the width of the plates desired.

When such drawings cannot be furnished us, we can produce them from photographs, pencil sketches, or designs of any kind accompanied with proper instructions. Photographs taken in the usual way, and of any convenient size, we can use.

Change of Size.—Wood-cut prints of the coarser kind may often be reduced to half their lineal dimensions, while others will admit of very little reduction, and some of none at all.

Most lithographic and steel-plate prints will admit of no reduction.

Very fine prints of any kind may be *enlarged* moderately without detriment.

Any prints which cannot be satisfactorily reduced or enlarged may be *redrawn* and thus brought to any desired size.

In all cases of reduction and enlargement, the relative proportions remain unchanged.

Proofs.—Whenever desired, we will furnish tintype proofs of the drawings made by us, for approval or correction, before engraving. A printed proof is furnished with each plate.

Time.—We cannot usually engage to fill an order for a single plate in less than from three to six days; larger orders will require longer time.

Estimates will be promptly furnished when desired. That these may be definite and correct, the copy to be used—whether print, photograph, sketch, or drawing—should always be submitted for our examination, together with a distinct statement of the size of plate wanted, and of any other details to be observed.

Terms.—To insure attention, all orders must be accompanied by an advance of half the price charged, the balance to be paid on delivery.

Electrotyping and Printing.—We have recently added to our establishment excellent facilities for making electrotypes, and also three power presses specially fitted for printing plates of all sizes in the finest manner.

Artificial Light.—We have just introduced this most important facility, which enables us to prosecute our work *in cloudy weather*, and to push forward hurried orders *in the night*.

References.—Our plates are now used by the principal publishers in this city, and by most of the leading houses in every State in the Union.

Send stamp for illustrated circular.

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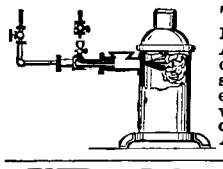
Drills, Bolt and Gear Cutters, Milling Machines. Special Machinery. E. GOULD & EBERHARDT, Newark, N. J.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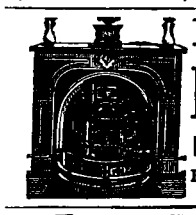
STEAM PUMPS.
HENRY R. WORTHINGTON,
239 Broadway, N. Y. 83 Water St., Boston.
THE WORTHINGTON DUPLEX PUMPING ENGINES FOR WATER WORKS—Compound, Condensing or Non-Condensing. Used in over 100 Water-Works Stations.
STEAM PUMPS—Duplex and Single Cylinder.
WATER METERS. OIL METERS.
Prices Largely Reduced.

AN ENGLISH ENGINEERING FIRM, with large connections, desires to undertake in England the manufacture of a thoroughly good and trustworthy steam pump, patented in England, and is open to receive particulars of hydraulic and other specialties. Address X. 73, at C. H. May & Co.'s General Advertising Offices, 78, Gracechurch Street, London.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Celebrated Original Baltimore
Fire Place Heaters
Mantels and Registers.
B. C. BIBB & SON,
Baltimore, Md.
Best workmanship. Lowest prices guaranteed. Send for circulars.

LADIES can make $5 a day in their own city or town. Address ELLIS MAN'F'G CO., Waltham, Mass.

PRATT & WHITNEY CO., DROP HAMMERS.
HARTFORD, CONN.,
Make Specialties of
PUNCHING PRESSES, HAND DRILLING MACHINES, SCREW PLATES, RATCHET DRILLS, BOLT CUTTERS, &c., &c., &c.

A GOOD PLAN

The most profitable plan for operating in stocks is that of uniting capital of various sums by combining or pooling the orders of thousands of customers and using them as *one mighty whole*, which has been done so successfully by Messrs. Lawrence & Co., Bankers, 57 Exchange Place, N. Y. City. By this co-operative system each investor is placed on an equal footing with the largest operator, and profits are divided *pro rata* among shareholders every 30 days. An investment of $10 would pay $50, making 5 per cent on the stock during the month. $25 would return $150, or 6 per cent.; $100 would make $1,000, or 10 per cent., and so on, according to the market. *Frank Leslie's Illustrated Newspaper*, June 29th, says: "The Combination method of operating in stocks is the most successful ever adopted." *New York Independent*, Sept. 12th, says: "The combination System is founded upon correct business principles, and no person need be without an income while it is kept working by Messrs. Lawrence & Co." *Brooklyn Journal*, April 29th, says. "Our editor made a net profit of $101.25 on an investment of $20 in one of Messrs. Lawrence & Co.'s combinations. The firm's new circular (copyrighted and sent free) contains "Two unerring rules for success in stock operations," and explains everything. All kinds of Stock and Bonds wanted. New Government Loan supplied. Best references. Address *Lawrence & Co., Bankers and Brokers*, 57 Exchange Place, New York City.

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Engraving Process!!!!
Perfect Substitute for Wood-Cuts.
ARTISTIC PRINTING. FINE ELECTROTYPING.
Photo-Plate Company
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Can be printed on an ordinary Press.
RELIEF PLATES in hard Type Metal FOR Newspaper & Book Illustration.
Send Stamp for Illustrated Circular.
MUCH CHEAPER THAN WOODCUTS.
State where you saw this.

PROPOSALS FOR MAIL-LOCKS.

POST OFFICE DEPARTMENT,
WASHINGTON, D. C., August 15, 1878.
Separate sealed proposals will be received at this Department until 12 o'clock noon on the 20th day of March, 1879, for furnishing four new and different kinds of Locks and Keys for the sole and exclusive use of the United States mails, including, besides those to be used for mail bags, such as are to be used for the street letter-boxes of the United States.
As the public exposure and searching examination necessary to intelligent bidding on any prescribed model of a lock and key would tend to impair, if not entirely destroy, the further utility of all such locks and keys for the purposes of the mails, the Postmaster-General prescribes no models or samples for bidders, but relies for a selection on the mechanical ingenuity and skill which a fair competition among inventors, hereby invited, may develop in samples submitted by them.
Specifications of requirements as to proposals, samples, kinds and quantities of locks and keys, contracts, etc., will be furnished on application by letter to the Second Assistant Postmaster-General.
No proposal will be considered which is not submitted in accordance with such specifications and forms of proposal.
The contracts which may be made are to be in conformity with the specifications and accepted proposals.
D. M. KEY,
Postmaster-General.

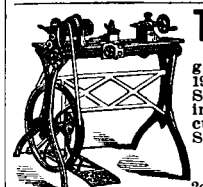
BRADFORD MILL CO.
Successors to Jas. Bradford & Co.
MANUFACTURERS OF
French Buhr Millstones,
Portable Corn & Flour Mills,
Smut Machines, etc.
Also, dealers in Bolting Cloths and General Mill Furnishing.
Office & Factory, 158 W. 2d St.,
CINCINNATI, O.
J. R. Stewart, *Pres.* W. R. Dunlap, *Sec.*
☞ PRICE-LISTS SENT ON APPLICATION.

IMPORTANT FOR ALL CORPORATIONS AND MANF'G CONCERNS.—**Buerk's Watchman's Time Detector**, capable of accurately controlling the motion of a watchman or patrolman at the different stations of his beat. Send for circular.
J. E. BUERK, P.O. Box 979, Boston, Mass.
N. B.—The suit against Imhaeuser & Co., of New York, was decided in my favor, June 10, 1874. A fine was assessed against them Nov. 11, 1876, for selling contrary to the order of the court. Persons buying or using clocks infringing on my patent will be dealt with according to law.

CARY & MOEN
STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS.
234 W. 29. ST. NEW YORK CITY

PROPOSALS FOR IMPROVEMENTS IN MAIL-BAGS AND MAIL-BAG TAGS.

POST OFFICE DEPARTMENT,
WASHINGTON, D. C., August 15, 1878.
Proposals from patentees or their assignees, for granting the use of improvements in the construction or in the mode of opening and closing mail-bags, of any or all kinds, and in the manufacture or materials thereof, and also for the use of patented devices for tagging or labeling the same, will be received at this Department until 12 o'clock noon on the 2d day of December, 1878.
All proposals must be in accordance with the specifications and form of proposal which will be furnished on application by letter to the Second Assistant Postmaster-General.
The contracts which may be made for the use of any patents will be in conformity with such specifications and the accepted proposals.
D. M. KEY,
Postmaster-General.


THE "ACME."
A regular thorough-made Engine Lathe. Swings 7 in., turns 19 in., is back geared, and cuts Screws from 4 to 64 threads per inch. ☞ Send 3c. stamp for Circular and Price List of Lathe and Small Tools. to
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Manuf'r Acme Lathe,
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BIG PAY to sell our Rubber Printing Stamps. Samples free. Taylor Bros. & Co., Cleveland, O.

THE DRIVEN WELL.
Town and County privileges for making **Driven Wells** and selling Licenses under the established **American Driven Well Patent**, leased by the year to responsible parties, by
WM. D. ANDREWS & BRO.,
NEW YORK.

60 Chromo and Perfumed Cards [no 3 alike]. Name in Gold and Jet, 10c. CLINTON BROS., Clintonville, Ct.

Two in One. Reversible "LINENE" Collars. Fine muslin on both sides. Every way perfect. Patent Stitch. Will suit. Dealers sell them. Any size mailed *free*. REVERSIBLE COLLAR CO., Boston, Mass.

HAND SAW MILL SAVES THREE MEN'S labor. S. C. HILLS, 78 Chambers St., N. Y.

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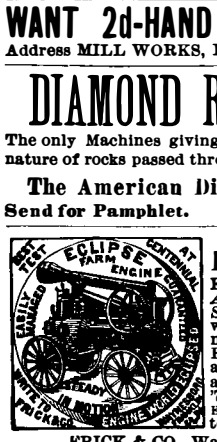
WANT 2d-HAND WATER WHEELS.
Address MILL WORKS, Drawer 294, Indianapolis, Ind.

DIAMOND ROCK DRILLS,
The only Machines giving a solid core showing exact nature of rocks passed through.
The American Diamond Boring Co.,
Send for Pamphlet. NEW YORK.



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Eclipse Engine
Furnishes steam power for all *Agricultural* purposes, *Driving Saw Mills*, and for every use where a first-class and economical Engine is required. Eleven first-class premiums awarded, including Centennial '76. Refer to No. 7, issue of '77, No. 14, issue of '78, of SCIENTIFIC AMERICAN, for Editorial illustrations.
FRICK & CO., Waynesboro, Franklin Co., Pa.
When you write please name this paper.

American Standard Gauge and Tool Works,
PHILADELPHIA, U. S. A.
Standard Gauges and Measuring Implements, Hardened Steel Turning Mandrels, Adjustable Blade Reamers, Patent Tool Holders, Lathe Drivers.
JOHN RICHARDS & CO.,
22d and Wood Streets, Philadelphia.
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Pyrometers, For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, etc.
HENRY W. BULKLEY, Sole Manufacturer,
149 Broadway, N. Y.

Every Man His Own Printer!

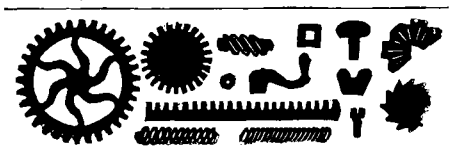
$3 Press Prints labels, cards etc. (Self-inker $5) 9 Larger sizes For business, pleasure, young or old Catalogue of Presses, Type, Etc., for 2 stamps. KELSEY & Co. Meriden, Conn

Mill Stones and Corn Mills.
We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing, specially adapted to Flour Mills. Send for catalogue.
J. T. NOYE & SON, Buffalo, N. Y.

TO ADVERTISERS! We fill orders for the insertion of advertisements in the newspapers of the United States and Dominion of Canada. To furnish advertisers with reliable information concerning newspapers and their rates, and thus enable the most inexperienced to select intelligently the mediums best adapted to any particular purpose, WE ISSUE SEMI-ANNUAL EDITIONS OF
AYER & SON'S MANUAL
FOR ADVERTISERS. 164 8vo. pp. Gives the names, circulation, and advertising rates of several thousand newspapers in the United States and Canada, and contains more information of value to an advertiser than can be found in any other publication. All lists carefully revised in each edition, and where practicable prices re uced. The special offers are numerous and unusually advantageous. It will pay you to examine it before spending any money in newspaper advertising. The last edition will be sent postpaid to any address on receipt of 25 cents by N. W. AYER & SON, ADVERTISING AGENTS, Times Building, Philadelphia.

CAMERON Steam Pumps
For Mines, Blast Furnaces, Rolling Mills, Oil Refineries, Boiler Feeders, &c.
For Illustrated Catalogue and *Reduced* Price List send to Works, Foot East 23d St., New York.

Woodward Steam Pumps and Fire Engines.
G. M. WOODWARD,
76 and 78 Centre Street, New York.
Send for catalogue and price list.



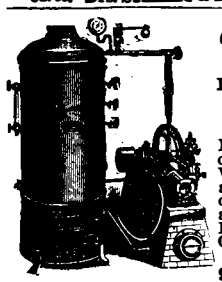
Small Tools of all kinds; GEAR WHEELS, parts of MODELS, and materials of all kinds. Castings of Small Lathes, Engines, Slide Rests, etc Catalogues free.
GOODNOW & WIGHTMAN, 176 Wash'n St., Boston, Mass.

PERFECT
NEWSPAPER FILE
The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.
Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN.

PATENT COLD ROLLED SHAFTING.
The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS,
Try Street, 2d and 3d Avenues, Pittsburgh, Pa.
190 S. Canal Street, Chicago, Ill., and Milwaukie, Wis.
☞ Stocks of this shafting in store and for sale by FULLER, DANA & FITZ, Boston, Mass.
Geo. Place Machinery Agency, 121 Chambers St., N. Y.

THE STANDARD AND ONLY RELIABLE PORTABLE ROOFING.
ASBESTOS ROOFING
For steep and flat roofs in all climates. In rolls ready for use. Easily applied by any one.
Asbestos Liquid Paints, Coatings, Cements, Boiler Coverings, &c.
H. W. JOHNS M'F'G CO., 87 Maiden Lane, New York.
Send for Samples, Illustrated Catalogues, Pric lists, etc.

COMPOUND OXYGEN The new cure for *Consumption, Asthma, Catarrh, Headache, etc.*, by a *revitalizing process.*
REMARKABLE CURES *have been made in Chronic and Nervous Diseases, which are attracting wide attention.*
REFER BY PERMISSION To Rt. Rev. Jno. J. Keane, Bishop of Richmond, Va.; Hon. Wm. D. Kelley, Gen. Fitz Henry Warren, T. S. Arthur, and others who have used and *been largely benefited by this treatment.*
SENT FREE! Brochure [200 pp.] with many testimonials to *most remarkable cures.* DRS. STARKEY & PALEN, 1112 Girard St., Phila.



SNYDER'S
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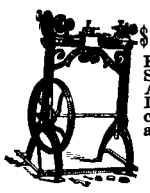

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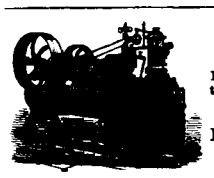

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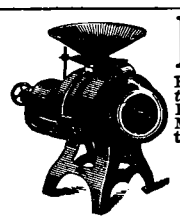

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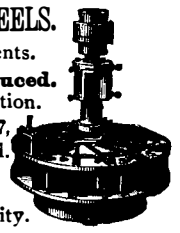

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